

U113
12
Jm
1940

TM 9-315

WAR DEPARTMENT

U.S. Army

TECHNICAL MANUAL

75-MM GUN AND CARRIAGE,
M1917, AND MODIFICATIONS



• • •

U 113
.2

TM 9-315

1-2

TECHNICAL MANUAL }
No. 9-315

TM 9-315
1940



WAR DEPARTMENT,

WASHINGTON, October 1, 1940.

75-MM GUN AND CARRIAGE, M1917, AND MODIFICATIONS

Prepared under direction of the
Chief of Ordnance

	Paragraphs
CHAPTER 1. General	1-3
2. Gun and carriage.	
Section I. Data	4-6
II. Description and operation	7-12
III. Disassembly and assembly	13-21
IV. Inspection	22-24
V. Functioning	25-27
VI. Care and preservation	28-38
3. Sighting and fire control equipment.	
Section I. Sighting equipment	39-44
II. Fire control equipment	45-51
4. Ammunition	52-79
5. Spare parts and accessories	80-81
6. Subcaliber equipment	82-86
7. Material affected by gas	87-89
APPENDIX. List of references	Page 95
INDEX	97

CHAPTER I

GENERAL

	Paragraph
Purpose	1
Scope	2
References	3

1. **Purpose.**—This manual is published for the information and guidance of the using arms and services.

2. **Scope.**—*a.* This manual contains all the essential information of a technical character required by the using arms and services for the identification, use, and care of the particular equipment described,

M558634

as well as use and care of ammunition, spare parts and accessories, and sighting and fire control equipment.

b. Disassembly and assembly and repairs by battery personnel will be undertaken only under the supervision of an officer or the chief mechanic.

c. In cases where the nature of repair, modification, or adjustment is beyond the scope and/or facilities of the battery personnel, the local or otherwise designated ordnance service should be informed in order that trained personnel with suitable tools and equipment may be provided.

3. References.—All Technical Manuals, Field Manuals, firing tables, standard nomenclature lists, and other publications pertaining to the matériel described herein are listed in the Appendix.

sories,
el will
chief

tment
local
order
y be

iring
ining

CHAPTER 2
GUN AND CARRIAGE

	Paragraphs
SECTION I. Data.....	4-6
II. Description and operation.....	7-12
III. Disassembly and assembly.....	13-21
IV. Inspection.....	22-24
V. Functioning.....	25-27
VI. Care and preservation.....	28-38

SECTION I

DATA

	Paragraph
75-mm gun, M1917.....	4
Carriage, M1917 and M1917A1.....	5
Recoil mechanism with gravity tank.....	6

4. 75-mm gun, M1917.

Weight of gun and breech mechanism.....	pounds..	1,010
Caliber.....	inches..	2.95
Muzzle velocity.....	f/s..	1,825

5. Carriage, M1917 and M1917A1.

Weight of gun and carriage complete, M1917	M1917	M1917A1
	pounds..	2,945
Weight of gun and carriage complete, M1917A1		
	pounds..	2,990
Length of recoil of gun on carriage.....	inches..	41
Maximum angle of elevation.....	degrees..	15
Maximum angle of depression.....	do....	-5
Traverse of gun on carriage.....	mils..	144

6. Recoil mechanism with gravity tank (both models).

Type.....	Hydrospring
Recoil oil.....	pints..

SECTION II

DESCRIPTION AND OPERATION

	Paragraph
Description of 75-mm gun, M1917-----	7
Operation of breech mechanism-----	8
Operation of firing mechanism-----	9
Description of 75-mm gun carriage, M1917A1-----	10
Description of 75-mm gun carriage, M1917-----	11
Operation of 75-mm gun carriage, M1917A1 and M1917-----	12

7. Description of 75-mm gun, M1917.—*a. General.*—The gun (fig. 1) is of the built-up type, consisting of a tube, a series of layers of steel wire, jacket, and a breech ring. The name and model of the gun are stamped on the top of the breech ring. The name of the manufacturer, year of manufacture, serial number, and weight, including the breech mechanism, are stamped on the muzzle.

(1) The tube forms the interior of the gun barrel and is rifled. Over the exterior rear portion of the tube are wound layers of flat steel wire.

(2) The jacket fits over the tube assembly. Longitudinal projections on each side of the jacket form guides for the gun when assembled to the cradle.

(3) The breech ring is screwed to the tube. The breech recess of the breech ring is threaded and slotted to correspond with the threads on the breechblock. A plane on the upper right side of the breech ring forms a seat for the gunner's quadrant. A lug at the top of the breech ring is bored to receive the counterrecoil buffer of the recoil mechanism.

b. Breech mechanism (fig. 2).—(1) The breech mechanism consists mainly of the breechblock, breechblock carrier, hand lever, and firing mechanism.

(2) The breechblock is of the interrupted screw type. It has two threaded and two flat sectors, in rear of which is a cylindrical section on which is a thread for securing the breechblock to the breechblock carrier. The breechblock is bored axially to form a housing for the firing mechanism. The front of the axial hole is closed by the breechblock bushing and held in position by the breechblock bushing fixing screw. The rear end is closed by the striker guide block which is held in place by means of the hand lever hinge bolt passing through it. A hole through the breechblock and channels formed in the breechblock carrier provides a vent for any gases escaping from ruptured primer or cartridge case.

(3) The breechblock carrier is hinged on the right side of the breech recess by the carrier hinge bolt. It is bored out and threaded to

receive the breechblock. The outer face of the carrier is recessed for the striker guide block, and two lugs are provided for the hinge bolt of the hand lever. A stop for limiting the rotation of the breechblock when in its open position is fitted on the front face of the breechblock carrier.

(4) The hand lever is provided with bevel teeth which engage with corresponding teeth formed on the rear face of the breechblock. The hand lever is retained in the closed position by means of a catch with flat spring, pivoted in the lever, one end of which engages a recess in the lower lug on the rear face of the breechblock carrier.

c. Firing mechanism.—The mechanism is of the continuous pull type and is so arranged that the gun cannot be fired until the breechblock is in its fully closed position and the hand lever locked.

d. Extractor.—The extractor is hinged to the right side of the breech ring. The yoke portion of the extractor bears against the inner rim face of the cartridge case and ejects the case from the chamber when the breech is opened.

8. Operation of breech mechanism.—*a.* To open breech grasp hand lever, at the same time compress hand lever retaining catch. Rotate hand lever to rear.

b. To close breech grasp hand lever and rotate it to front until it is locked by hand lever retaining catch.

9. Operation of firing mechanism.—To fire pull firing gear connecting rod handle (fig. 6) to rear. After firing, the handle is returned by a spring attached to the lever and the guard protecting the cannoneer.

10. Description of 75-mm gun carriage, M1917A1.—*a. General.*—(1) The M1917A1 gun carriage (fig. 4) is a modified 75-mm gun carriage, M1917 (British) (fig. 6). This modification consists of removing the running gear and the application of new parts to provide for high speed transport. In all other respects these carriages are identical. The description following applies to both models; their differences are specified by referring to the model of carriage.

(2) The gun carriage is constructed to allow 16° elevation and 5° depression of the gun which recoils in a cradle, the latter being fitted with a recoil cylinder to limit the recoil to about 41 inches and counterrecoil springs to return the gun to battery. The carriage is also constructed so that the elevation of the gun can be altered without interfering with the line of sight.

(3) The carriage may be traversed right or left 72 mils.

b. Principal parts.—The principal parts of the carriage are the top carriage, cradle, recoil and counterrecoil mechanism, gravity tank, elevating gear, range gear, traversing gear, firing gear, and trail.

(1) *Top carriage.*—(a) The top carriage consists of two triangular shaped brackets connected by transoms, and provided with bearings on the under side at the front, through which the axle passes and by which it is pivoted for traversing. To the under side at the rear is fitted a bracket in which is formed a groove to fit over the traversing bracket on the trail. Bearings are fitted on the top front to receive the cradle trunnions which are held in position by capsquares.

(b) An arc, which is used in conjunction with a clamp on the trail and top carriage to lock the top carriage to the trail in traveling, is fitted on the right side to allow adjustment of the clamp as required.

(2) *Cradle.*—(a) The cradle trunnions pivot in bearings of the top carriage. The left trunnion is threaded for a stud which supports the rocking bar sight. The lower portion of the cradle encircles the gun and the upper portion of the spring case. Longitudinal recesses are cut in the inner surface of the lower portion for the reception of the guides on the jacket of the gun. A guard is attached to the left side for the protection of the gunner. On the top of the upper rear portion of the cradle a V-notch is cut, and the upper front portion is tapped to receive the foresight.

(b) A spindle with clutches and a handle is fixed to the top carriage, so that when the gun is fully elevated the clutches may be made to engage with semicircular shaped lugs formed on the under side of the cradle and rigidly fix the cradle to the carriage. Two stops are fitted to the top carriage to limit the travel of the handle of the clutch spindle. In the event of the clutches becoming jammed and difficult to release, this can be overcome by easing the lower elevating wheel by hand before unclamping.

(3) *Recoil mechanism.*—(a) The recoil mechanism (fig. 14) which is contained in the spring case in the upper portion of the cradle consists of a cylinder, piston with rod, counterrecoil buffer, and stuffing box and gland. The cylinder is closed at the rear by the counterrecoil buffer and at the front by the stuffing box and gland which are locked in the required position by a spring stud. A number of longitudinal grooves are formed on its inner surface, the depths of which are graduated so that the space for the flow of liquid between the piston and the cylinder varies during recoil; by this means an approximate constant pressure is maintained in the cylinder throughout the stroke. The front end of the piston rod is fixed to the front of the spring case. The rear end is bored for the reception of the

counterrecoil buffer, which by displacing the liquid inside the piston rod allows the gun to return to battery without undue shock.

(b) A filling hole, closed by a plug with chain, is provided near the top rear end of the cylinder.

(c) The recoil cylinder contains 5.4 pints of recoil oil.

(d) The running out springs surround the recoil cylinder and are inclosed in a steel case which is screwed into the cradle above the gun. They consist of two sets, inner and outer (fig. 14), which are held under initial compression between an external flange on the front end of the recoil cylinder and an internal flange at the rear end of the outer spring case. Each set is divided into four sections separated by spring separators; the inner and outer sets are also separated longitudinally by an inner spring case.

(e) For the better detection of a leak in the gland, holes are bored in the spring case; four holes near the rear end of the inner spring case, and two holes underneath, one at the front and one at the rear of the outer spring case.

(4) *Gravity tank.*—(a) The object of this tank is to replace the oil lost in firing. It insures the recoil cylinder being constantly filled. It contains 2.4 pints of oil.

(b) The gravity tank is bolted to the front end of the recoil mechanism and is protected from gunfire by a shield. The oil from the tank reaches the recoil cylinder through the hole in the piston rod.

(c) The changes made necessary to equip carriage with the gravity tank are the application of a different spring case cap, alteration of the recoil cylinder to take the air valve, and the assembly of a hollow piston rod, if carriage was originally equipped with solid rod.

(5) *Elevating and range gear.*—(a) The elevating gear is divided into two portions (fig. 9), upper and lower, by employment of a double-ended elevating screw to the center of which is attached a rod carrying a bracket to which the arc of the range gear and sights are attached.

(b) The gears are so arranged that the elevation of the gun can be altered without altering the line of sight. The handwheel (fig. 9) on the left of the carriage is for alining the sight on the target, while the handwheel on the right side is actuated until the required range is indicated on the yards and degrees scale ring.

(c) The yards and degrees scale ring (fig. 9) is fitted to the right side close to the handwheel and consists of a ring graduated on its face in yards; the periphery of the ring is graduated in mils. The ring is prevented from slipping by two fiber washers (fig. 8), one on each side of the ring. The washer on the inside bears between the

ring and a spring case and that on the outside between the ring and a jamming plate.

(d) The range ring indicator pinion (fig. 8) is supported in bearings in the cradle. The pinion meshes with the range gear arc supported from the center of the elevating screw. The range ring spring case contains a range ring spiral spring which eliminates backlash between the arc and pinion.

(e) The dial sight bracket is fastened to the arc which provides the seat for the panoramic telescope carrier. This carrier is provided at its upper end with a slot and detent for holding and clamping the panoramic telescope.

(f) The telescope carrier may be raised in its seat to permit sighting over the main shield. A clamp screw is provided for holding it in its proper position.

(6) *Traversing gear*.—The traversing gear consists principally of a crosshead (fig. 10), actuating screw connecting link, traversing actuating screw, and handwheel. The crosshead is pivoted vertically to the traversing bracket slide on which the rear end of the top carriage slides. The working parts are protected from dust by cotton packing around the outside of the link and held in place by the crosshead packing cap. The actuating screw connecting link is connected to the top carriage by the actuating screw connecting link pin. By means of the handwheel on the end of the traversing screw the top carriage may be traversed 72 mils right or left. An azimuth strip fastened to the top carriage and an azimuth pointer attached to the crosshead indicate the angle of traverse.

(7) *Firing gear*.—The firing gear is so arranged that the cannoneer can fire the gun without altering his position when laying. It is attached to the left side of the cradle and consists principally of a connecting rod, firing gear connecting arm, and a spring lever which engages with the firing trigger (fig. 2) of the gun. The connecting arm is pivoted to a fulcrum on the cradle at one end; the other is connected to the spring lever by the connecting rod, which is provided with a handle for operating the gear.

(8) (a) *Trail*.—The trail is tubular and is secured to the axle by a bracket (fig. 15). The rear end of the tube is fitted with a blade, trail lifting handles, lunette bracket assembly, lunette, and a traversing lever which is folded down on the trail and held by the traversing lever securing clip. Near the lower end of the tube the trail locking band is shrunk on, this band being for reinforcement. Brake bands are bolted together on the tube. To these bands are attached tensile stays (fig. 16) and tie rods which brace the axletree and axle brackets.

Above brake bands (fig. 15), traversing bracket slides are assembled, a dovetailed projection on slide forming the guide for the rear end of the top carriage in traverse. In front of traversing bracket slides, traversing lock bands are assembled, to which the traversing lock lever (fig. 11) is attached.

(b) *Axletree*.—The axle is a tubular steel forging; it passes through the axletree bearing assembled to the top carriage and bracket (fig. 15) assembled to the trail, and is secured by the axletree centering pin which passes through the trail bracket and the axle.

(c) *Shield*.—The shield is of armor plate. It is in three parts, the upper and lower portions being hinged. The main portion is attached to the axletree by supporting brackets and to the trail by a flange with bolts. The lower portion when traveling is secured to the trail by a pawl with a releasing lever and locking pin. The upper portion of the shield is lowered for traveling or when using aiming points in conjunction with the panoramic telescope in front of the battery. The panoramic telescope opening is provided with a hinged shutter.

c. *Additional parts*.—(1) *Brake mechanism*.—(a) The brakes (fig. 18) of the M1917A1 carriage are of the internal expanding type. The brake shoes (fig. 20) are actuated by the hand brake levers which are connected to cam shaft levers assembled to the brake cam shafts by the spring actuated brake rods.

(b) The movement of the brake levers (fig. 18) is controlled by the brake ratchet pawl engaging teeth in the ratchet rack. The brake lever for the left wheel rotates on the brake shaft, while the brake lever for the right wheel is welded to a tube and rotates on the brake shaft.

(c) The brake shoe (fig. 20) is a flanged segment the outer diameter of which is covered with a brake lining and secured by ten brake shoe lining rivets. When the brake shoes are secured to the brake housing plate assembly by the brake cam roller pin and brake shoe link pin and connected with the brake shoe adjusting wedge by the brake shoe links and brake cam rollers, they are held in contact with the brake cam by the three brake shoe retracting springs. The assembly is designated as the "brake."

(d) When engaging the brake of the M1917A1 carriage, the movement of the brake levers (fig. 18) through the linkage rotates the brake cam (fig. 20) causing the brake cam rollers to ride toward the high point of the brake cam and thereby forcing the brake shoes against the brake drum (fig. 19) secured to the hub of the disk and rim

wheel. When the brake levers are released, the tension on the extracting springs and the spring on the brake rod causes the brake cam to rotate to the released position. This action forces the brake cam rollers to the low point of the brake cam and thereby releases the pressure of the brake shoes against the brake drum.

(2) *Disk and rim wheels of the M1917A1 carriage.*—The assembly consists of a commercial disk and rim (fig. 19) upon which is mounted a commercial 7.5 by 24 inch heavy duty truck balloon tire. The inner tube of the tire is a commercial 7.5 by 24 inch bullet sealing balloon tire tube equipped with a Schrader valve. The tire is secured to the disk and rim by a tire locking ring.

(3) *High speed adapter.*—(a) The high speed adapter of the M1917A1 carriage consists of left and right axle brackets, group assemblies, disk and rim wheel assemblies, and tie rods (fig. 16).

(b) The axle brackets, left and right, are assembled over the left and right ends of the axletree and are retained in correct alinement by a bolt assembled through the bracket and axletree. Tie rods (fig. 16) are bolted to the brackets and trail.

(c) The brake housing plate assembly of the brake assembly is attached to the axle brackets by four cap screws.

11. *Description of 75-mm gun carriage, M1917.*—a. *Brake mechanism (fig. 17).*—The tire brake is for use when traveling and is also used when firing. It consists principally of two brake arms, two bell cranks, connecting rods, and an actuating screw. The brake arms are pivoted at one end to a bracket on the trail and provided at the other end with the service cast-iron brake shoe, which acts on the wheels. Each of the bell cranks is pivoted to brackets on the axle, one on each side of the carriage body; one arm of each lever is connected in front of the axle by a connecting rod; the outer arm of the right-hand lever is provided with a nut through which the front end of the actuating screw passes, the other end of the screw being linked to the right brake arm. The other arm of the left-hand lever is connected to the left-hand brake arm by a rod and eccentric link; a release lever with an eccentric pivoted to the connecting rod and link enables the brake to be quickly released when required. When traveling, the lever is secured by a quick release strap and the connecting rod by a leather tie passed around it and the left tensile stay at the front of crossing.

b. *Wheels.*—The wheels of the M1917 carriage (figs. 5 and 6) are 56 inches in diameter, with steel flanges, pipe box, and a 3-inch steel tire. The wheels are secured to the axle by wheel collars and linch-

pins. A hub cap is secured on to the outer end of the pipe box, inclosing the wheel collar, linchpin, and the end of the axle.

12. Operation of 75-mm gun carriages, M1917A1 and M1917.—*a. Elevating and depressing.*—The handwheel on the left of the carriage is for alining the sight on the target (the range indicator remains stationary), while the handwheel on the right side is actuated until the required range is indicated on the yards and degrees scale ring (figs. 8 and 9) (the sight remaining stationary).

b. Traversing.—The traversing handwheel is located on the left side of the carriage and is assembled on the actuating screw. Movement of the traversing handwheel to the right or left causes the top carriage to slide. An azimuth strip assembled to the top carriage indicates the angle of traverse.

c. Brake.—The brake of the M1917 carriage (fig. 17) is applied by turning the handle of the actuating screw located in front of the shield or by the cross handle near the center of the actuating screw.

SECTION III

DISASSEMBLY AND ASSEMBLY

	Paragraph
General	13
Disassembly of breech mechanism	14
Assembly of breech mechanism	15
Disassembly of recoil mechanism	16
Assembly of recoil mechanism	17
Disassembly of outer spring case from cradle	18
Assembly of outer spring case to cradle	19
Disassembly of yards and degrees scale ring	20
Assembly of yards and degrees scale ring	21

13. General.—*a.* Incidents of wear, breakage, cleaning, and inspecting necessitate the occasional disassembly and assembly of various parts of the gun and carriage. This work comes under two headings—that which can be performed by the battery personnel with the equipment furnished, and that which must be performed by trained ordnance personnel.

b. In the disassembly and assembly of a majority of parts authorized for issue to the using arm, no detailed instructions are necessary as the disassembly and assembly operations are self-explanatory.

14. Disassembly of breech mechanism.—Grasp hand lever and open mechanism; remove cotter pin (fig. 2) from hand lever hinge bolt and withdraw bolt. Remove hand lever and striker guide block.

Set safety catch in firing position and remove firing lever and striker. Slide firing pin out of groove in front end of striker. Press top of firing spring guide so as to compress firing spring slightly and at the same time tilt upper end of guide from striker and withdraw guide and firing spring. Force safety catch out of its recess in striker guide block toward center and withdraw it. Press breechblock retaining catch into its seat in breechblock carrier and unscrew breechblock (to right) from breechblock carrier. Withdraw breechblock retaining catch. Remove cotter pin from carrier hinge bolt and remove breechblock carrier. Remove cotter pin of extractor hinge bolt and withdraw bolt and extractor. Remove cotter pin from firing trigger lever and withdraw lever and trigger lever bushing assembly from left side of gun.

15. Assembly of breech mechanism.—Reverse order of disassembly as outlined in paragraph 14.

16. Disassembly of recoil mechanism.—*a.* Care should be taken that no one is standing in front of the carriage while the operation of disassembly or assembly is being performed.

b. The majority of the carriages are equipped with gravity tanks; a few are without the tanks. Therefore, the following instructions should cover both carriages.

(1) In the case of carriages equipped with gravity tanks, elevate gun 10° and remove gravity tank (fig. 14) by removing shield and three bolts holding gravity tank to spring case cover, care being taken to catch oil from piston rod. Depress gun and drain piston rod of oil. Remove outer recoil cylinder nut which will allow cylinder to bear against outer spring case cap.

(2) In carriages not equipped with gravity tank, place gun at depression and remove outer recoil cylinder nut (fig. 13) which will allow cylinder to bear against outer spring case cap.

c. Attach spring compressor to counterrecoil plunger or buffer (fig. 14) and take up tension on running out spring.

(1) Remove piston rod nut (fig. 13), outer spring case cap, and recoil filling plug.

(2) Release gradually spring compressor and inner recoil cylinder nut (fig. 13) as springs are released.

(3) When the springs are fully extended remove spring compressor, outer running out spring and inner running out spring (fig. 13), and spring separators, bearing washers, spring stirrup, and recoil cylinder from the front. Care must be taken when removing the cylinder that the filling hole is kept upright to prevent loss of oil.

17. Assembly of recoil mechanism.—a. Slightly depress the gun.

(1) Assemble outer rear running out spring washer (fig. 13) at end of outer spring case with radius to rear, and insert three outer running out springs and spring separators in correct order.

(2) Insert spring stirrup with outer front running out spring washer (radius to front) and one outer running out spring in position.

(3) Place an inner running out spring (fig. 13) with rear inner running out spring washer in spring stirrup (radius to rear) and insert two more inner running out springs with spring separators in correct position.

(4) Place front inner running out spring washer (fig. 13) (radius to front) and remaining inner running out spring on recoil cylinder.

(5) Attach spring compressor to counterrecoil plunger or buffer (fig. 14).

(6) Assemble recoil cylinder, care being taken that filling hole is at top and that inner recoil cylinder nut (fig. 13) is put on spring compressor before latter enters lug of gun. Assemble outer spring case cap and piston rod nut on piston rod (first seeing that cotter pin for stuffing box retaining lock is placed in position and point opened), care being taken to insure that keyway in cap engages key on end of piston rod.

(7) Compress springs, care being taken that keys on end of cylinder are in correct position to enter keyways in lug of gun, and that inner recoil cylinder nut (fig. 13) is correctly secured by screwing it up while compressing springs.

b. Screw on outer spring case cap (fig. 13) remove spring compressor, and replace piston rod nut. Assemble gravity tank and shield. Refill recoil cylinder and gravity tank with heavy recoil oil, low pour point type.

18. Disassembly of outer spring case from cradle.—a. Disassemble recoil mechanism as outlined in paragraph 16.

b. Set gun at zero elevation (fig. 8). Slide gun to rear (care being taken not to cramp it) and remove it from cradle.

c. Remove upper protectors (curved) foresight (fig. 13), upper elevating handwheel pinion (fig. 8), and range ring indicator pinion.

d. Unscrew outer spring case (fig. 13) from cradle. This may be accomplished by winding three or more coils of rope around the cylinder. Then loop one end of rope around handspike and tighten on coils of rope to unscrew cylinder.

19. Assembly of outer spring case to cradle.—a. Reverse instructions outlined in paragraph 18.

b. Before mounting gun, protector slide on front end of cradle should be removed to prevent leather portion of protector forcing out metal and breaking off screws when sliding gun into battery.

20. Disassembly of yards and degrees scale ring.—Remove rocking bar sight and disconnect rod connecting elevating screw at arc joint; withdraw arc until it is out of gear with pinion, holding spring case by hand while doing so; gradually release tension (by hand) on spring by allowing spring case to revolve slowly, so as to prevent breaking of spring, and remove jamming plate and allied parts from spindle.

21. Assembly of yards and degrees scale ring.—Place spring barrel on bearing on cradle and spring case with spring on spindle; turn spring case by hand to front until spring is at full tension, release spring case about a quarter of a turn, and engage arc and connecting rod; replace yards and degrees scale ring, washers, and jamming plate. Replace rocking bar sight and adjust yards and degrees scale ring to horizontal plane of gun.

SECTION IV

INSPECTION

	Paragraph
Gun.....	22
Carriage, 75-mm gun, M1917A1.....	23
Carriage, 75-mm gun, M1917.....	24

22. Gun.—The following instructions with reference to inspections should be scrupulously observed by all concerned:

Parts to be inspected
in order of inspection

Points to observe

a. Gun.

a. Note general appearance; smoothness of operation of breech mechanism. Disassemble breech mechanism and see that it is thoroughly cleaned and well lubricated. Note condition of bore; erosion at origin of rifling; burs or roughness of leveling plate.

b. Breech recess.

b. Note whether there are scores, bruised or deformed threads.

c. Breechblock.

c. Note whether there are scores, burs, bruised or deformed threads.

d. Firing mechanism.

d. Note condition of each part of mechanism, whether it is burred, deformed, or broken.

23. Carriage, 75-mm gun, M1917A1.

Parts to be inspected
in order of inspection

Points to observe

- | | |
|---------------------------------|---|
| <i>a.</i> Carriage. | <i>a.</i> Note general appearance, whether oil holes, oil cups, and buttonhead fittings are painted red, carriage painted in accordance with regulations, and all moving parts properly lubricated. |
| <i>b.</i> Elevating mechanism. | <i>b.</i> Elevate and depress gun through full extent of its travel. Note whether mechanism operates without binding or undue backlash. |
| <i>c.</i> Traversing mechanism. | <i>c.</i> Traverse carriage throughout its movement. Note smoothness of operation without binding or undue backlash. |
| <i>d.</i> Traveling clutch. | <i>d.</i> Operate traveling clutch spindle. Note whether it locks cradle to top carriage without backlash. |
| <i>e.</i> Traversing lock. | <i>e.</i> Operate traversing lock lever. Note whether it locks top carriage to trail. |
| <i>f.</i> Brake mechanism. | <i>f.</i> Test brakes by placing carriage in firing position, wheels clear of ground. Set brake hand levers. Note position of brake ratchet pawl on brake ratchet. If in last tooth brake shoe should be adjusted. Release brake hand lever to "off" position. Note whether wheels revolve freely without drag. |
| <i>g.</i> Disk and rim wheels. | <i>g.</i> (1) Examine disk and rim wheel nuts. Note condition and that they are set up tight. Note rim of the disk and rim to determine whether it is deformed.
(2) Examine tire. Note if crown of tire is taking wear. If worn to left or right, test alinement of wheels. |

24. Carriage, 75-mm gun, M1917.—Inspection of this carriage will follow the same procedure as given in paragraph 23 with the exception of the following instructions:

Parts to be inspected
in order of inspection

Points to observe

- a.* Brake mechanism. *a.* Test brakes by turning brake handle located in front of shield. See that brake shoes rest evenly on steel tire of wheel; also note if one shoe is worn more than the other. Release brake by means of quick release lever and see that all parts function properly.
- b.* Wheel. *b.* Test tightness of wheel tire by tapping lightly with a hammer.
 - (1) See that all wheel flange bolts are tight.
 - (2) Test end play by grasping spokes and moving wheel in and out.
 - (3) Pull out on top and push in on bottom of wheel. Hold wheel in this position and place a scale or straightedge on shield with its end touching inner edge of top of tire. Then push in on top and pull out on bottom of wheel. The distance between end of scale or straightedge and inner edge of top of tire represents rock of wheel on axle. The maximum allowance for rock is $\frac{3}{32}$ inch. When rock is greater than $\frac{3}{32}$ inch replace wheel.

SECTION V

FUNCTIONING

	Paragraph
Functioning of recoil mechanism.....	25
Malfunction of gun.....	26
Malfunction of carriage.....	27

25. Functioning of recoil mechanism.—*a.* When the gun recoils on firing, it draws the recoil cylinder with it to the rear; the liquid in the cylinder in passing from front to rear of piston is forced through the grooves in the cylinder, which sets up a hydraulic resistance, thus absorbing the energy of recoil and bringing the gun to rest. The shape of the grooves is such that the flow space gradually diminishes, and by this means the stability of the

carriage is never disturbed. Meanwhile the running out springs have been further compressed; their subsequent expansion causes the gun to return to the firing position, and in doing so the counter-recoil buffer displaces the liquid in the rear end of the piston rod, the liquid escapes over the tapered flats, which results in the gun returning to battery without undue shock.

b. The object of a gravity tank is to replace oil lost in firing. It insures the recoil cylinder being constantly filled.

26. Malfunction of gun.

Malfunction	Cause	Correction
a. Fails to fire; no percussion on primer.	a. Broken firing spring; broken or deformed firing pin.	a. Disassemble firing mechanism and replace broken or deformed parts.
b. Fails to fire until after several percussions on primer.	b. (1) Firing mechanism parts not working freely.	b. (1) Disassemble firing mechanism and examine carefully for burs. Remove burs or rough spots with crocus cloth or an oilstone. Wash parts in dry cleaning solvent; dry and lubricate with light class D lubricating oil before assembling.
	(2) Weak firing spring.	(2) If correction in (1) above does not remedy condition, it may be inferred that firing spring is weak. Replace spring.
c. Fails to fire when proper percussion on primer is obtained.	c. Defective primer.	c. Wait 2 minutes and then insert another round of ammunition.
d. Fails to extract empty case.	d. Broken extractor.	d. Ram case out gently from muzzle. Examine edge of chamber for burs which might cause difficult extraction. Remove burs with an oilstone. Replace extractor.

27. Malfunction of carriage.

Malfunction	Cause	Correction
Gun fails to re- turn to battery.	<i>a.</i> Weak or broken springs.	<i>a.</i> Disassemble recoil mechanism and replace springs.
	<i>b.</i> Dirt or lack of lubrication on gun slides and cradle guideways.	<i>b.</i> Level gun horizontally. Disassemble counterrecoil buffer outer nut. Slide gun to rear, wash gun slides and cradle guideway with dry- cleaning solvent; dry and lubricate with light class D lubricating oil. Slide gun into battery and assemble counterrecoil buffer outer nut.
	<i>c.</i> Recoil cylinder gland too tight.	<i>c.</i> Loosen slightly.
	<i>d.</i> Gun slides or guideway distorted.	<i>d.</i> Notify ordnance main- tenance company.

SECTION VI

CARE AND PRESERVATION

	Paragraph
Gun	28
Carriage.....	29
Recoil mechanism.....	30
Brake mechanism.....	31
Brake mechanism of 75-mm gun carriage, M1917.....	32
Lubrication instructions.....	33
Cleaners and abrasives.....	34
Preservatives	35
Paint and related materials.....	36
Lubricants.....	37
Miscellaneous materials and tools.....	38

28. Gun.—*a. General.*—(1) It is of importance whenever the rate of firing permits that the cannoneer look through the bore before loading to ascertain that no particles of the cartridge case, wadding, or unburned powder remain in the bore. The presence of such particles causes imprints in the bore and sometimes premature explosions. During night firing the sponge should be used between rounds.

(2) When shells burst near the gun, make sure before firing that neither the exterior nor the muzzle face of the bore have been struck by fragments. Any injuries affecting the bore of the gun are likely to cause the tube to split if the gun is fired. Bulges at any part of the gun or any unusual condition which appears should be reported at once to the ordnance inspector of artillery.

(3) In cleaning after firing, wash the bore with a solution made by dissolving $\frac{1}{2}$ pound of soda ash or 1 pound of sal soda in 1 gallon of water, using the sponge for swabbing purposes. Wipe perfectly dry, using sponge covered with burlap, and then oil the bore with a light coat of rust-preventive compound.

(4) The surface for setting the gunner's quadrant should be protected from injury. Do not lay tools or other articles upon its surface. In case of accidental injury, repair must be made by the personnel of the ordnance maintenance company.

(5) The gun slides should be examined by pushing the gun to the rear until $\frac{3}{4}$ of the slide is exposed. Burs or rough spots should be removed with a fine file. Wash the slides with dry-cleaning solvent and wipe dry. Coat the slides with light class D lubricating oil and push gun into battery.

(6) If the matériel should be left unused for any considerable length of time, the bore of the gun, breech mechanism, and all bright and unpainted surfaces should be thoroughly cleaned with dry-cleaning solvent so as to be free from rust, water, and lubricating oil before coating the surface with rust-preventive compound. The various covers must also be placed in position.

b. Breech mechanism.—(1) The breech mechanism should be kept clean and all parts well-lubricated at all times. The mechanism should be disassembled periodically when not in use to discover if any rust is forming. When in use it should be disassembled at frequent intervals, cleaned, and oiled, and should always be so cared for immediately after each firing period.

(2) Do not use a steel hammer directly on any part of the breech mechanism. A copper drift or hardwood block should be interposed or a copper hammer used to prevent deforming the parts.

(3) Vigilance must be exercised to detect any cutting or abrasions forming on the pressure side of the threads of the breechblock and breech recess. If the breechblock does not rotate smoothly or requires a greater effort than usual to operate, it should be disassembled and examined. Scoring or bruises on the threads of the breechblock and breech recess should be removed by personnel of the ordnance maintenance company.

c. Firing mechanism.—(1) The firing mechanism parts require the same careful attention as the breech mechanism and should be disassembled from the breechblock frequently for cleaning and oiling.

(2) Wear in the firing mechanism is almost negligible except for deformation of the firing pin. If the firing pin is examined **after** each firing period it can be anticipated when replacement is necessary before malfunction results.

(3) To remove rust-preventive compound from matériel taken from temporary storage, the greater part should be scraped off and the balance removed with a rag or cotton waste dipped in dry-cleaning solvent.

(4) Lubricating instructions for the various parts of the gun are given in paragraph 33.

29. Carriage.—*a. General.*—(1) The carriage cannot be kept in serviceable condition unless proper attention is given to cleaning, lubrication, and loose or broken parts. All bearing surfaces, screw threads, and exterior parts must be kept as clean as possible. When disassembling and assembling operations are being carried on, extra precautions must be taken to prevent the entrance of foreign matter into the working parts. Dry-cleaning solvent is issued by the Ordnance Department for cleaning purposes.

(2) In case the carriage is to be stored or to remain unused for any considerable length of time, all bright and unpainted surfaces should be protected with rust-preventive compound.

(3) The carriage should be jacked up high enough for the wheels to clear the ground.

b. Precautions.—Precautions to be observed to prevent violent recoils and consequent damage to the carriage are as follows:

(1) Before going into action the recoil cylinder packing rings should be carefully examined and changed if defective.

(2) When tightening up a packing ring, the gland should not be screwed home, metal to metal, in the stuffing box. If the packing cannot be made tight without doing this, a fresh packing must be used or an additional thin ring packing put in.

(3) Recoil cylinder should be correctly filled before going into action and examined from time to time to see that it is full.

(4) As often as opportunity permits, the gland should be examined and, if necessary, screwed up when the recoil cylinder is hot from firing. The packing is then very plastic and is easily squeezed to make a good joint.

(5) If, during firing, oil is being lost from the recoil cylinder and recoil becomes excessive, the packing ring must be either renewed or

adjusted; otherwise the gun will most certainly be put out of action in a short time, and most probably the recoil mechanism will be damaged.

NOTE.—Spare packing rings soaked in tallow should be kept ready for immediate use.

c. To tighten or renew packing.—If any leakage of oil takes place at the gland, the packing should be tightened; if this will not stop the leak, the packing must be renewed.

d. To tighten packing (gun in position).—(1) For carriages equipped with recoil cylinders having the gland lock on the under side, the gravity tank (if the carriage is so equipped), the piston rod nut, and outer spring cylinder cap must be removed. For carriages having the gravity tank, and the gland lock on the upper side of the recoil cylinder, nothing need be removed. Lift the outer spring case cap cover.

(2) Screw up gland with spanner No. 122. While in use the spanner must be kept against the face of the gland in order to disengage the gland lock. The position of the gland after screwing up must permit of the gland lock reengaging with a slot in the gland.

(3) Replace spring case cap, piston rod nut, and gravity tank (if the carriage is so equipped), taking care that key on piston rod and keyway in cap are properly engaged.

e. To renew packing ring in stuffing box (gun in position).—(1) Empty cylinder at counterrecoil buffer and replace buffer.

(2) Remove gravity tank (if carriage is so equipped). Unscrew and remove piston rod nut and front cap. Then unscrew gland and withdraw outer packing supporting ring with tools supplied, and replace with fresh material, using metal collar of packing tools to assist packing ring over shoulder of piston rod. Replace supporting ring, gland, and cap, piston rod nut, and gravity tank (if the carriage is so equipped), and refill cylinder.

(3) If there is any difficulty in removing the old packing from the stuffing box, the latter should be removed from the recuperator cylinder and the packing removed by inserting the plug of the packing tool into the stuffing box and driving the packing out.

NOTE.—If the gun is not in position, the spring compressor must be attached to the counterrecoil buffer before the gap is removed.

f. Elevating gear.—In replacing the bearings and elevating nuts, care must be taken that the open side of the bearings is inserted first in the upper gear and the closed side first in the lower gear (with the teeth of the elevating nuts at the top in both cases), so as to insure that the gun is always elevated by revolving the handwheels toward the rear or depressed by revolving the handwheels toward the front.

g. Yards and degrees scale ring.—(1) The meter and mil scale should be kept perfectly clean, free from grit, burs, or dents, and the revolving surfaces slightly greased.

(2) In replacing the eccentric bushing in the arc guides, care must be taken that the bushing is placed in such a position as to insure the least possible play between the teeth of the pinion and the elevating arc. The grooves in the eccentric bushing which engage the stop pin are arranged to give eight adjustments, numbered 1 to 8, Nos. 1 and 8 representing the minimum and maximum setting, respectively.

(3) A certain number of bushings have the grooves numbered 1 to 8, but Nos. 1 and 5 indicate the minimum and maximum setting, respectively.

(4) The order of adjustment for each pattern bushing is as follows:

Adjustment	Nos. 1 and 8, minimum and maximum	Nos. 1 and 5, minimum and maximum
First.....	1	1
Second.....	2	2
Third.....	3	8
Fourth.....	4	3
Fifth.....	5	7
Sixth.....	6	4
Seventh.....	7	6
Eighth.....	8	5

h. To remove yards and degrees scale ring.—Remove rocking bar sight and disconnect rod connecting elevating screw at arc joint; withdraw arc until it is out of gear with pinion, holding spring case by hand while doing so; gradually release tension (by hand) on spring by allowing spring case to revolve slowly so as to prevent breaking of spring, and remove jamming plate and allied parts from spindle.

i. To replace yards and degrees scale ring.—Place spring barrel on bearing on cradle and spring case with spring on spindle; turn spring case by hand to front until spring is at full tension, release spring case about a quarter of a turn, and engage arc and connecting rod; replace yards and degrees scale ring, washers, and jamming plate. Replace rocking bar sight and adjust yards and degrees scale ring to horizontal plane of gun.

j. Traversing gear.—The pivot of the crosshead should be kept properly screwed up and any lateral play in the traversing screw adjusted by tightening the crosshead cap and the check nut.

k. Clamping gear for top carriage.—(1) This clamp should always be on when traveling. To put on the clamp, the lever is pulled to the

rear, which tightens the nut and draws the carriage down to the trail, thus making it difficult to turn the traversing handwheel.

(2) If, owing to the wear, the lever cannot be moved sufficiently to tighten the clamp properly, it must be moved to another position on the octagonal nut.

(3) In action the lever must be pushed as far forward as possible.

l. Cradle clamping gear.—(1) Care should be taken that the handle of the clutch spindle is always against the stops when not in use.

(2) The cradle can only be clamped when the gun is at extreme elevation. The gear is intended for use when traveling only.

(3) In replacing the clamping gear, the clutches (which are left and right) must be correctly placed on the spindle, that is, the thinnest portion of the eccentric being to the front, and both in the same relative position on the spindle, so as to engage the bearing on the cradle at the same time.

m. Capsquares.—To remove capsquares for cleaning, etc., the top carriage must be traversed as far as it will go to left to admit the right cap key being removed, and to the right to remove the left key.

30. Recoil mechanism.—*a.* When the recoil mechanism has been completely disassembled it will require 7.8 pints of liquid to fill the recoil cylinder and gravity tank. To fill the mechanism perform the following operations:

- (1) Elevate gun to zero elevation.
- (2) Remove filling plug.
- (3) Remove tank plug and tank valve seating.
- (4) Open recoil cylinder air valve.
- (5) Retract gun about 18 inches.
- (6) Using a funnel, fill recoil cylinder through both filling hole and gravity tank.

(7) Permit gun to return to battery slowly.

(8) Repeat 5, 6, and 7 until 7.8 pints are in recoil cylinder and gravity tank.

(9) Close recoil cylinder air valve.

b. For carriages not equipped with gravity tank, measure off 5.4 pints of recoil oil and perform the following operations:

- (1) Place gun at maximum depression.
- (2) Remove filling plug.
- (3) Unscrew buffer about two turns.
- (4) Using a funnel, fill cylinder.
- (5) Draw off about $\frac{1}{10}$ pint of oil.
- (6) Replace filling plug and tighten buffer.

31. Brake mechanism.—*a.* The proper functioning of the brake is of vital importance. A freely operating brake insures a longer period of operation before readjustment becomes necessary.

b. Brake adjustment is accomplished by rotating the brake shoe adjusting wedge (fig. 20) which extends to the outside of the brake housing plate in the desired direction. The outside end of the brake shoe adjusting wedge is machined with a square for turning with a wrench.

c. The correct procedure for adjusting the brake is as follows:

(1) Set hand brake lever at full released position.

(2) Jack up wheel.

(3) Adjust brake shoe adjusting wedge until a drag is felt on wheel. Then back off just enough so that brake does not drag. Brakes must be cold when making this adjustment.

(4) The position of the hand brake lever can be adjusted by adjusting the length of the brake rod.

d. Wheel bearings should be adjusted to prevent brake drag due to loose bearings.

e. The brake cam and rollers are lubricated through a button head fitting. Lubrication must be held to the correct amount to avoid the brake lining becoming saturated with oil or grease. This condition will demand heavy brake handle pressure and the replacement of brake lining prematurely. Molded linings may be cleaned with dry-cleaning solvent to remove oil or grease.

32. Brake mechanism of 75-mm gun carriage, M1917.—Any wear in the eccentric can be adjusted by screwing up the connecting bolt of the eccentric link.

33. Lubrication instructions.—*a.* Excess wear can only be prevented by keeping the matériel clean and well lubricated.

b. Lubricating oils and greases prescribed in the lubricating chart must be used in the fittings and moving bearing surfaces as described therein.

c. Wheel hubs packed with grease at assembly should be cleaned and repacked every 6 months of continuous use. Other moving parts not specifically mentioned herein should be oiled with light class D lubricating oil once a month.

d. Lubricating fittings and oil holes are painted a vivid red for ease in locating.

LUBRICATION CHART

Location	Part	Lubricant	How applied	Remarks
Recoil clip	Bearing surface	Oil, lubricating, class D, light, SAE 20.	Brush	Oil exposed surfaces.
Breech mechanism	do	do	do	Dissassemble and lightly coat each part.
Firing mechanism	do	do	do	Do.
Range ring indicator pinion	Oil hole	do	Oiler	One on each end of pinion. Fill once a week.
Elevating handwheel lower pinion.	do	do	do	Remove button head, oil screws. Fill once a week.
Traveling clutch spindle	do	do	do	Oil holes in spindle clutch bearings assembled to top carriage. Fill once a week.
Capsquare	do	do	do	Fill once a week.
Axle bearing	do	do	do	Do.
Lunette	Fitting	Grease, lubricating, mineral, medium grade.	Grease gun	Do.
Lock, lunette	Oil cup	do	Oiler	Do.
Shaft, brake	Fittings	do	Grease gun	Do.
Brake lever, left	do	do	do	Do.
Cam shaft lever	do	do	do	Do.
Wheel hub	Packed	Grease, wheel bearing (short fibrous).	Hand	See par. 33c.

34. Cleaners and abrasives.—(See TM 9-850.) The following cleaners and abrasives are prescribed:

Cloth, crocus.

Cloths, wiping, cotton, mixed, sterilized (for machinery).

Compound, cleaning.

Lime, hydrated (lime slaked and powdered).

Paper for cleaning optical glass.

Paper, flint.

Polish, metal, paste.

Remover, paint and varnish.

Soap, castile.

Soda, ash.

Soda, caustic (lye), for cleaning purposes.

Solvent, dry cleaning.

Sponges.

Waste, cotton (two grades, colored and white).

a. Soap, castile.—(1) Used for cleaning leather equipment and as a component of saddle soap.

(2) The action of soap depends upon a chemical combination of alkalis in the soap and the grease which is to be softened and removed. The resulting soapy compound is readily washed off, leaving nothing to hold the dirt. The soap will thus remove some of the oil in the leather and repeated washings will probably require replacement of oil to prevent the leather from becoming harsh and brittle.

(3) Nearly all ordnance leather equipment is russet leather. When it becomes soiled it should be cleaned by carefully removing all hardened grease with a sliver of wood (not glass or knife) and washing with a sponge saturated with a heavy lather of castile soap and clean, tepid water. Rinse thoroughly and rub vigorously with a dry cloth until the leather is dry. Straps and other articles of unvarnished leather which become dry and brittle should be cleaned as described, and while the leather is still slightly moist should be given an exceedingly light coat of neat's-foot oil by rubbing with a soft cloth moistened (not saturated) with the oil. In cold weather the oil may be heated lukewarm (never hot). Wipe off any oil that the leather does not absorb. The article after being oiled should be hung in a warm place. Shellacked sole leather cases do not require oiling.

(4) Russet leather, as manufactured, is stuffed with a dubbing of cod liver oil and tallow, which is absorbed to the extent that the quality of the leather is improved and its life prolonged, but not enough oil remains on the surface to soil the clothing if the equipment is properly cared for. It should be noted that in the washing and oiling described above, if more than a light coat of oil be given, the

leather will be greatly darkened and will quickly soil the clothing. No method of cleaning will then restore the original light color of the leather or remove stains from it.

(5) Articles of black leather may be cleaned with castile soap, rinsed, and when nearly dry, lightly sponged with a mixture of 1 teaspoonful of lampblack in 1 pint of neat's-foot oil, the mixture having been first stirred until it has a glossy black appearance. The mixture should then be well rubbed into the leather. Leather equipment which has become wet should be dried in the shade. Wet leather exposed to the sun or to too high a heat from a stove or radiator becomes hard and brittle.

b. Sponges.—Used for washing and cleaning matériel. Natural sponges may be replaced by cellulose sponges in sizes Nos. 4, 6, 8, and 10 (approximate dimensions $1\frac{1}{4}$ by $3\frac{1}{8}$ by $4\frac{5}{8}$; $1\frac{5}{8}$ by $3\frac{1}{4}$ by $5\frac{1}{4}$; 2 by $3\frac{7}{8}$ by $6\frac{1}{4}$; $2\frac{1}{2}$ by $4\frac{5}{8}$ by $6\frac{1}{2}$). These latter sponges must not be wrung; squeezing only is the proper method.

c. Waste, cotton (two grades, colored and white).—(1) The colored cotton waste is used for general cleaning purposes on the exterior of ordnance matériel such as gun carriages and automotive vehicles. It is also used as calking for cracks from which it is desired to exclude dust and dirt.

(2) White waste is used for general cleaning purposes on finished surfaces of ordnance matériel. In lieu of white cotton waste an equivalent amount of clean wiping cloths may be used.

35. Preservatives.—*a. General.*—See TM 9-850 for information on rust, corrosion, inspection for corrosion rust preventives, preparation of metal surfaces for slushing, method of slushing, inspection of grease films and storage conditions.

b. Naphthalene, flake.—(1) A flaked form of moth ball.

(2) Used as a moth repellant to preserve the linings of helmets, felt wads, felt packings of instrument chests, carpet, gun sponges, and paint and varnish brushes. It is sprinkled thickly on the articles, which should, if possible, be then wrapped in paper covers and tightly boxed. The matériel should be thoroughly brushed and aired before packing and should be periodically inspected. If there are any signs of devastation by the moth larvae the articles must be unpacked, cleaned, and recharged with naphthalene.

(3) Naphthalene should be used in airtight receptacles in order to obtain a concentrated naphthalene vapor.

36. Paint and related materials.—(See TM 9-850.) The following paints and related materials are prescribed:

Lacquer.

Lead.

Mixture, liquid (for red lead paint).

Oil, linseed, raw.

Enamel, red, water-resistant.

Enamel, white.

Paint, ready mixed, olive-drab.

Stencil, black.

Stencil, white.

Shellac, orange.

a. Oil paints and their application.—(1) Paint is used for preservation against rust, deterioration, and decay of metals and woods. Some paints adhere to metal surfaces better than others, the liquids of the first or base coat seeming to penetrate very minute depressions or pits in the metal or to etch themselves into the surface and thus form a good bond for following coats. The paints are issued mixed and ready to apply except in a few instances. Paint stored in large containers should be well stirred before transfer to smaller containers. Ordnance matériel is well painted before issue and one maintenance coat per year should be ample for protection.

(2) Red lead paint is a good base coat on iron or steel. Red lead possesses no particular advantages as a base coat on nonferrous metals. Red lead paint does not keep well and must be mixed as needed. The formula for 1 gallon of it is 20 pounds of dry red lead with 3 quarts of liquid mixture. The usual process of mixture is to place a small amount of dry red lead in a suitable container, work a little of the mixture into it to form a paste, and then stir the rest of the liquid mixture into it.

(3) The standard olive-drab paint is issued mixed as for a third or finishing coat. It contains rather too much oil for a second coat, as it dries with a gloss to which succeeding coats will not adhere. For second coats it should, therefore, be thinned with turpentine in the proportions of 1 pint of turpentine to 1 gallon of standard paint or enough to cut the gloss. The standard olive-drab paint is retained and will be used in cases of emergency.

(4) For better appearance of ordnance equipment in the hands of troops in time of peace, long oil enamel over primer for long oil enamel (on metal surfaces) is authorized; also the same enamel over suitable wood priming coat for use on wood. For use on woodwork a sanding filler over the primer is also required. The sanding filler is a ready mixed semipaste but when thinned with 50 percent turpentine by volume has good brushing, covering, and leveling qualities. Long oil enamel may be applied with a brush or by spraying. These fillers and enamel dry in approximately 8 hours.

(5) Care must be used in preparing the surface for painting. It should be made thoroughly clean, dry, and smooth.

(6) All paint should be well stirred before using. If too thick, turpentine should be used as a thinner, but not to such an extent that the paint does not cover. The exact and proper thickness of each coat can be learned only by experience. If too thin it often cracks in drying, and if too thick it becomes blistered, wrinkled, and unequal. The first coat may, however, be much thinner than any of the succeeding coats.

(7) Parts to be painted may be washed in a liquid solution of 1 pound of soda ash in 8 quarts of warm water, then rinsed in clean water and wiped thoroughly dry.

(8) When artillery is in fair condition and only marred in spots, the marred places should be touched with enamel or paint and permitted to dry. The whole surface should then be sandpapered with No. 1 flint paper and repainted with a finish coat and allowed to dry thoroughly before use.

(9) When matériel is in bad condition, all parts should be thoroughly sandpapered with No. 2 flint paper, given a coat of enamel or olive-drab second-coat paint, and permitted to dry. It should then be sandpapered with No. 00 flint paper. Finally apply a finishing coat and permit the parts to dry thoroughly before use.

(10) After repeated paintings the paint may become so thick as to scale off in places or present an unsightly appearance. It may then be removed by the use of a lime and lye solution, the paint and varnish remover, or cleaning compound. It is important that every trace of lye, remover, or cleaning compound be rinsed off. Especial attention to this requirement is necessary in preparing wooden parts because of the porosity of the wood. In addition to the cleaning, woodwork should be properly putty stopped after the priming coat and before the second coat is applied.

(11) Oil cups, grease gun fittings, spring oil hole covers, and similar lubricating devices, as well as a spot $\frac{3}{4}$ inch in diameter around each oil hole, are painted red so that they may be readily located.

(12) At the conclusion of a job of painting, the brushes must be carefully washed clean with dry-cleaning solvent and kept in water, except that camel's-hair brushes after thorough cleaning should be laid flat on a shelf or other convenient clean surface in order that the hair may not be distorted. Worn paint brushes should be retained for use in spreading rust-preventive compounds. Any usable paint remaining in the paint pot should be kept tightly covered.

b. Lacquer.—A rapidly drying and very transparent liquid. Sets to touch in 3 minutes. Used on sandblasted metal surfaces of fire control and sighting equipment because of its transparency and to prevent tarnishing and deterioration. The lacquer, which must be thin enough to flow easily, is applied with a camel's-hair brush. Alcohol may be used as a thinner but only when absolutely necessary.

c. Lead.—(1) *General.*—Used as an extra heavy rust-preventive coating on exposed metallic surfaces. Various materials have been used to reduce the stiff lead paste to a more plastic and workable material. Since freedom from corrosive elements is desired, rust-preventive compound is preferable to lubricating oil for this purpose. Melted tallow is sometimes used. The white lead coating may be used for the preservation of matériel in stand-by condition, the idea being that it is more adhesive under extremes of temperature than rust-preventive compound. It should not be used on intricate working surfaces where it cannot be readily removed without damaging those surfaces.

(2) *Red, dry.*—(a) Separate requisition is required for the necessary liquid mixture for making red lead paint.

(b) Red lead paint is used as a base coat on iron and steel nonbearing parts of ordnance matériel. It has the effect of slightly etching the surface and so secures a good bond for succeeding coats.

d. Mixture, liquid, for red lead paint.—Used for mixing red lead paint.

e. Oil, linseed, raw.—Used as an auxiliary thinner for ready-mixed paint. As a thinner add small quantities of the raw oil at a time, stirring constantly until the paint flows freely under the brush.

f. Enamel, red, water resisting.—Used around oil holes and fittings for lubricants to attract attention and furnish ready identification. Also for target marking disks and aiming posts.

g. Enamel, white.—Used on aiming posts.

h. Paint, ready mixed, olive-drab.—Used for painting all types of ordnance matériel, unless otherwise specifically excepted.

i. Stencil, black.—Used for stenciling equipment, matériel, and emplacements, except on black background.

j. Stencil, white.—Used for stenciling equipment and matériel, except on white background.

k. Shellac, orange.—Used for finishing the inside of wooden chests.

37. Lubricants.—The following lubricants are prescribed:

Oil, lubricating, class D, SAE 20 (light).

Oil, lubricating, class D, SAE 50 (extra heavy).

Grease, lubricating, mineral, medium grade.

Grease, wheel bearing (short fibrous).

Oil, neutral.

a. Oil, lubricating, class D, SAE 20 (light).—Used when temperature is below 50° F., on 56-inch wheels, gun slides, breechblocks, elevating and traversing mechanisms, etc., of artillery.

b. Oil, lubricating, class D, SAE 50 (extra heavy).—Used when temperature is 50° F. or above, on 56-inch wheels, gun slides, breechblocks elevating and traversing mechanisms, etc., of artillery, and unless otherwise prescribed for general lubricating purposes in summer weather.

c. Grease, lubricating, mineral, medium grade.—Used in compression grease cups, pressure lubricating fittings and gear cases. In hot climates this grease may be found to be too light for use and the hard grade grease found more suitable. Usually applied with a grease gun.

d. Grease, wheel bearing (short fibrous).—Used instead of ordinary mineral grease in the wheels of all artillery carriages incorporating in their design antifriction bearings.

e. Oil, neutral.—(1) Used to lubricate delicate bearings of fire control and sighting instruments, unless otherwise prescribed. To be applied by dropping from end of the dropper attached to the stopper of the bottle or from the end of a piece of clean wire.

(2) In the oiling of fire control instruments only a few drops are needed. If more than necessary is used, it may run into the optical elements of the instrument and so affect the serviceability of the instrument as to require complete disassembly to remove the oil.

38. Miscellaneous materials and tools.—*a. List.*—For the purposes for which used see TM 9-850. These materials and tools are—

Brushes:

Mottling, No. 2 ($\frac{7}{8}$ inch).

Artist's, camel's-hair, round, No. 1 ($\frac{1}{8}$ inch).

Artist's, camel's-hair, round, No. 5 ($\frac{1}{4}$ inch).

Duster, painter's, round ($2\frac{1}{2}$ inches).

Sash tool, oval, No. 1 ($2\frac{7}{32}$ by $1\frac{3}{4}$ inches).

Sash tool, oval, No. 3 ($1\frac{3}{32}$ by $2\frac{1}{8}$ inches).

Scratch, painter's, handled (14 by $\frac{7}{8}$ inch).

Varnish, oval ($1\frac{7}{8}$ inches).

Burlap, jute, 8-ounce (40 inches wide).

Knife, putty.

Needle, sacking.

Palm, sailmaker's.

Twine, jute.

b. Care of brushes.—(1) The bristles of brushes are subject to attack by moths. Brushes in storage should be protected by naphthalene.

(2) Camel's-hair brushes after being thoroughly cleaned with turpentine should be laid flat on a horizontal surface (not in water). Other paint brushes should be cleaned after using and kept with bristles submerged in fresh water.

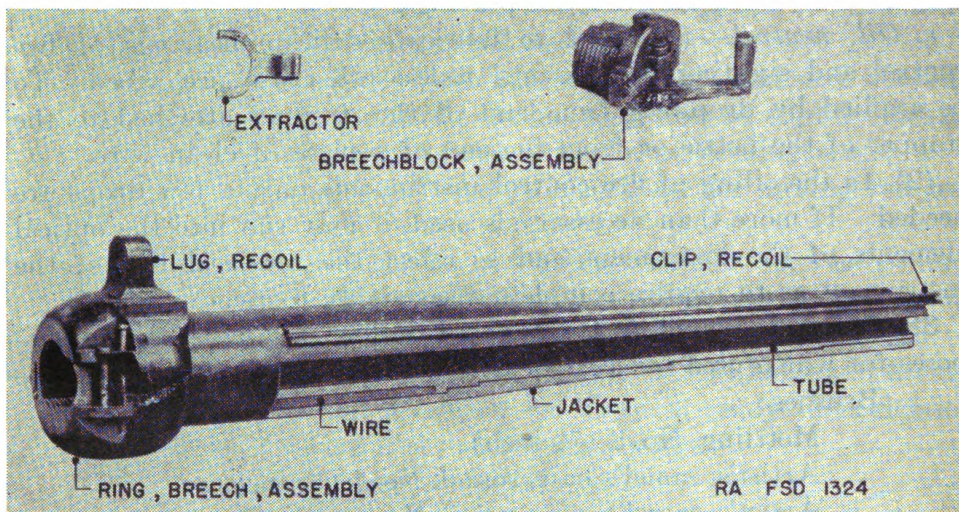


FIGURE 1.—Gun, 75-mm, M1917 (sectioned view).

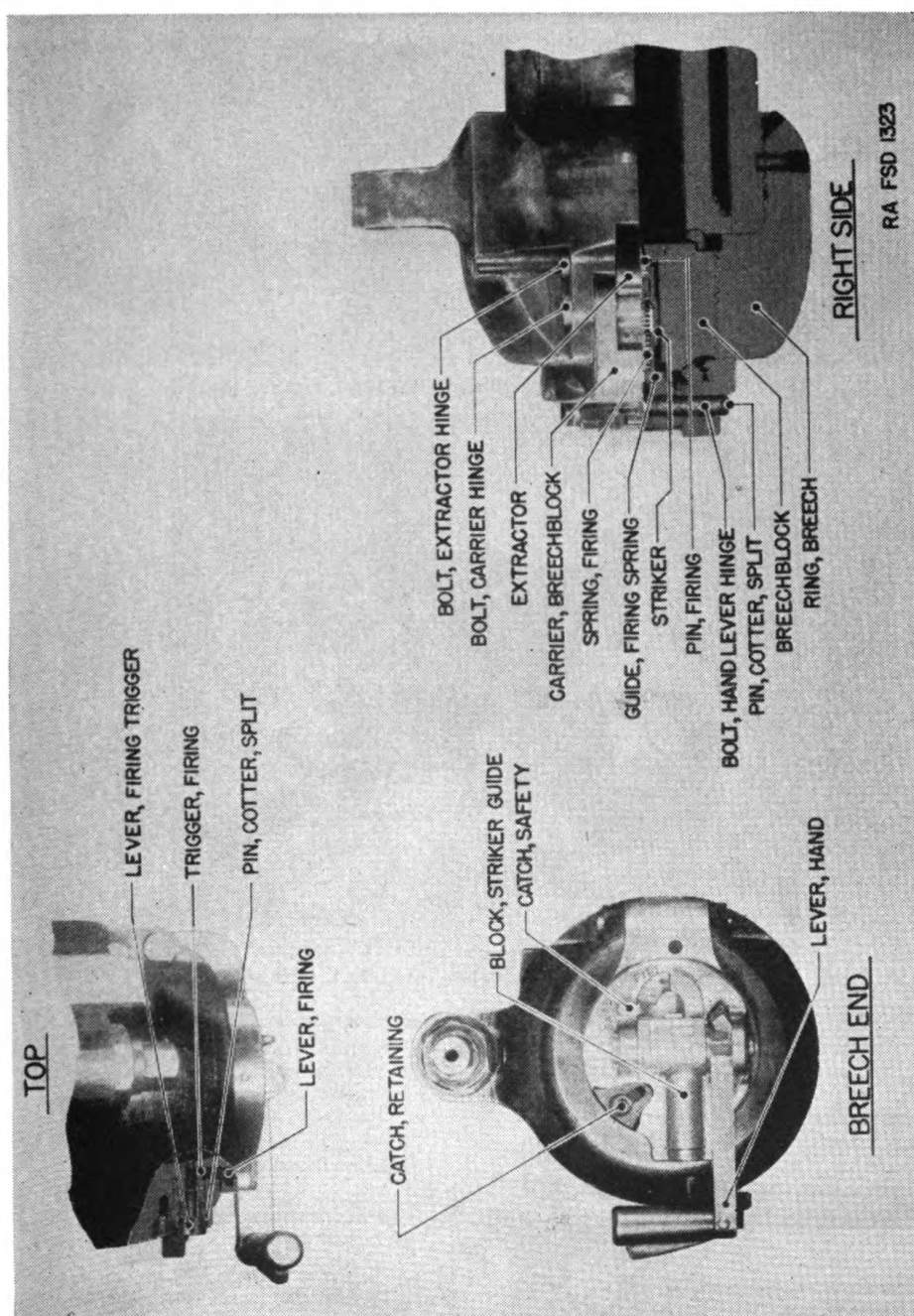
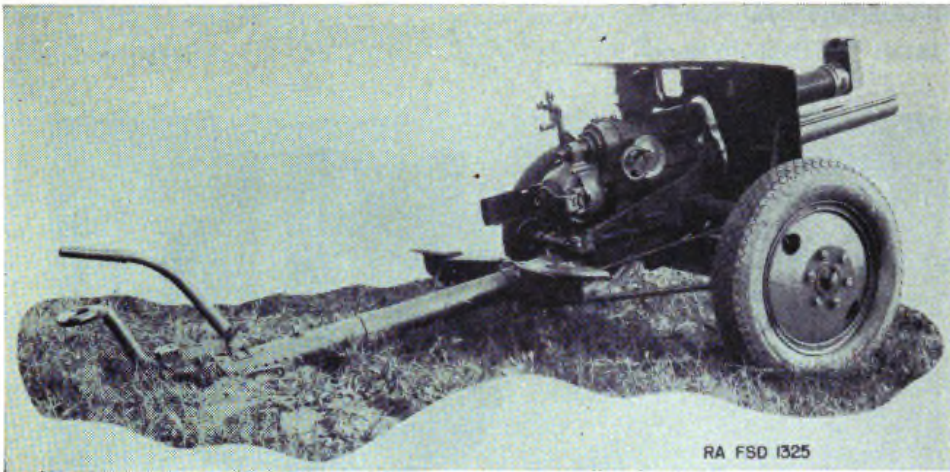
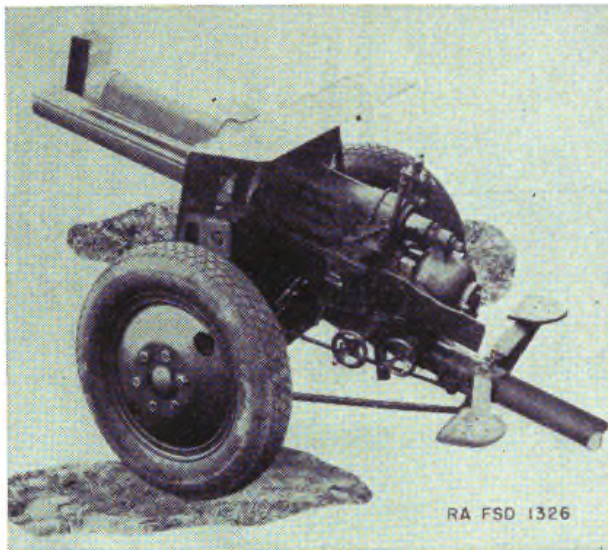


FIGURE 2.—Mechanism, breech (sectioned view).



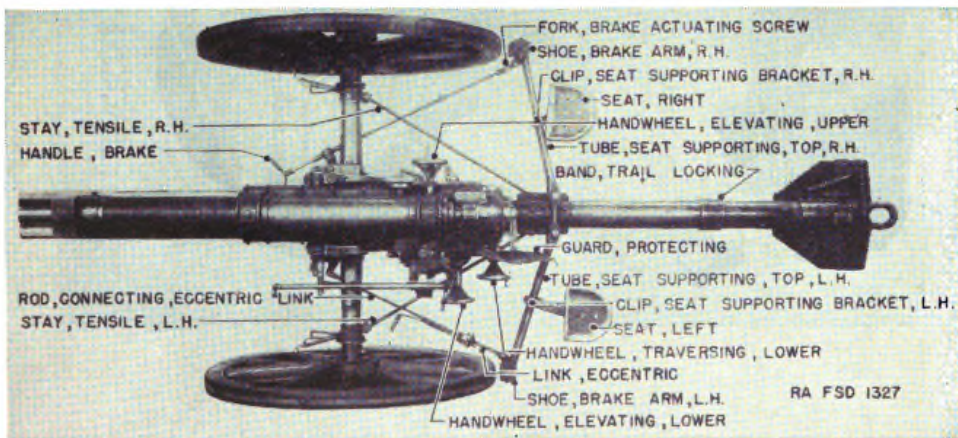
RA FSD 1325

FIGURE 3.—Carriage, gun, 75-mm, M1917A1 (right side).



RA FSD 1326

FIGURE 4.—Carriage, gun, 75-mm, M1917A1 (left side).



RA FSD 1327

FIGURE 5.—Carriage, gun, 75-mm, M1917 (plan view).

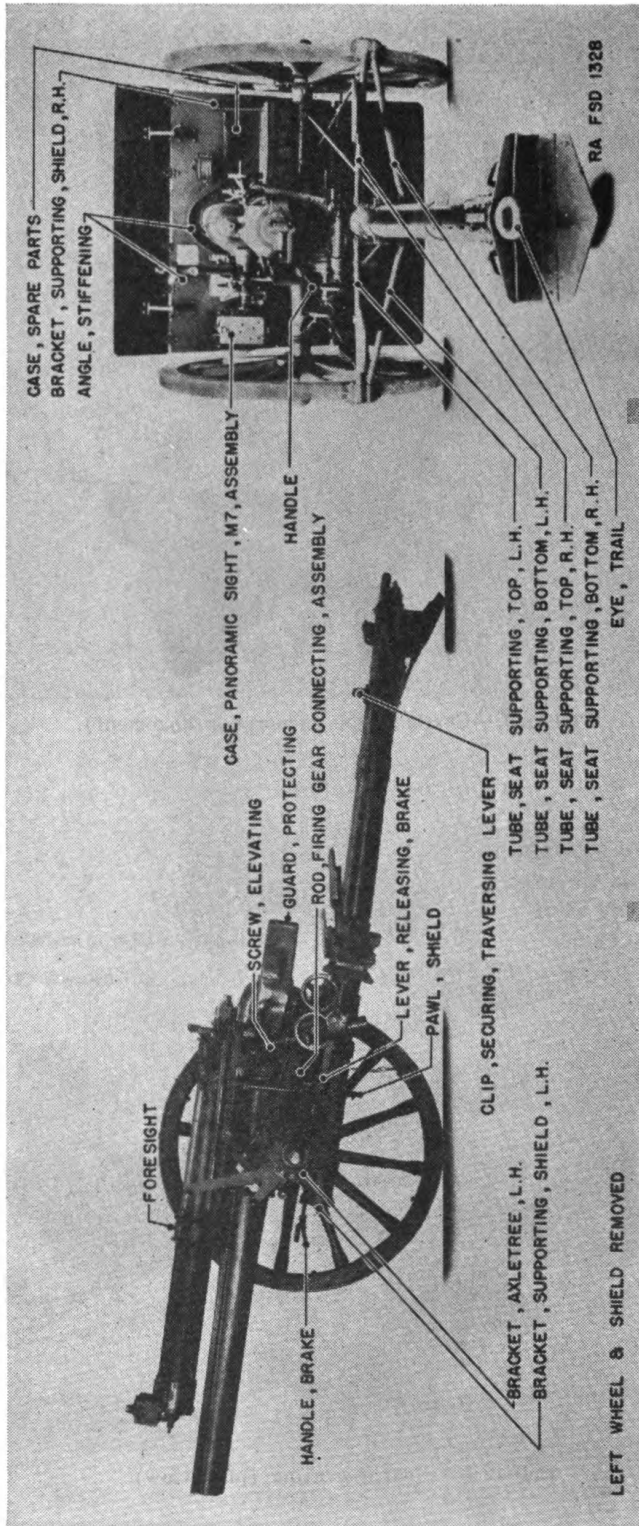


FIGURE 6.—Carriage, gun, 75-mm, M1917 (left side and rear).

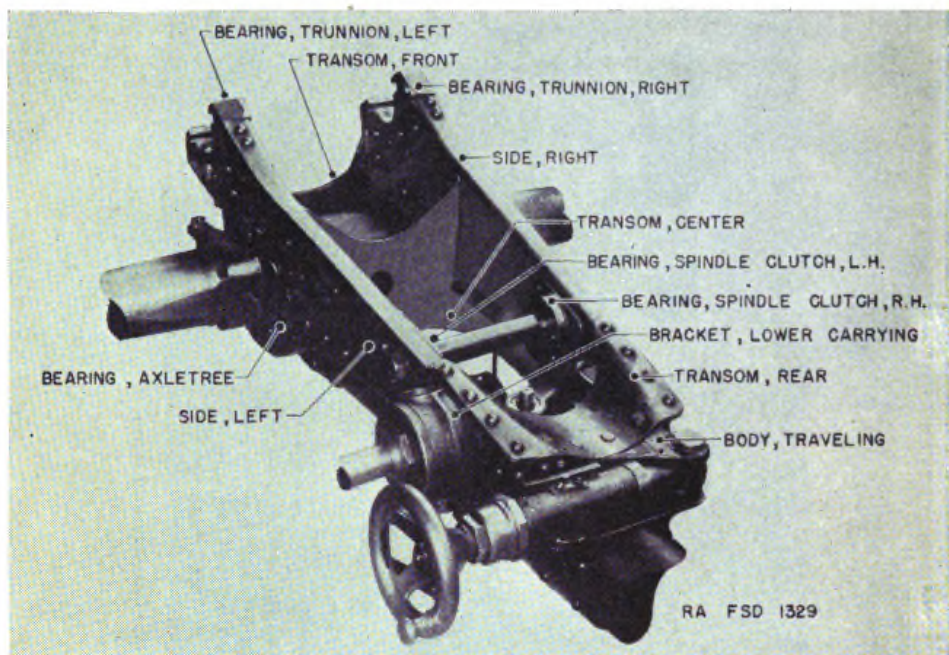


FIGURE 7.—Carriage, top (general arrangement).

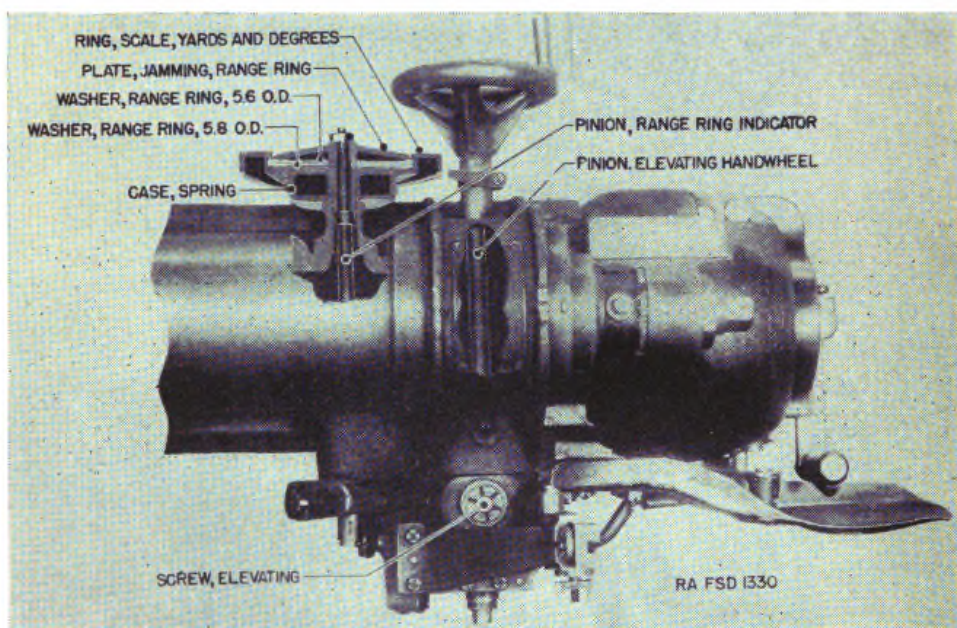


FIGURE 8.—Gear, elevating (plan view).

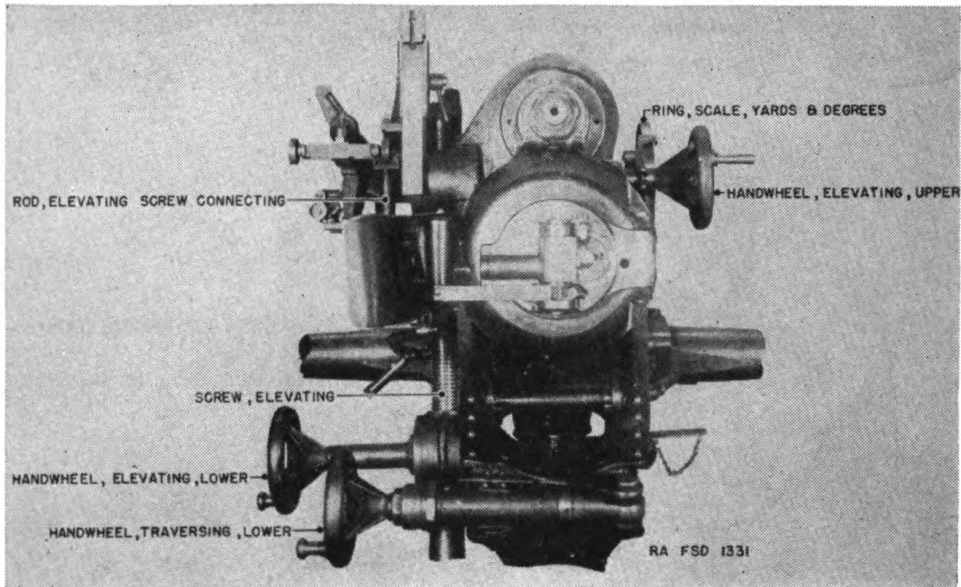


FIGURE 9.—Gear, elevating (rear elevation).

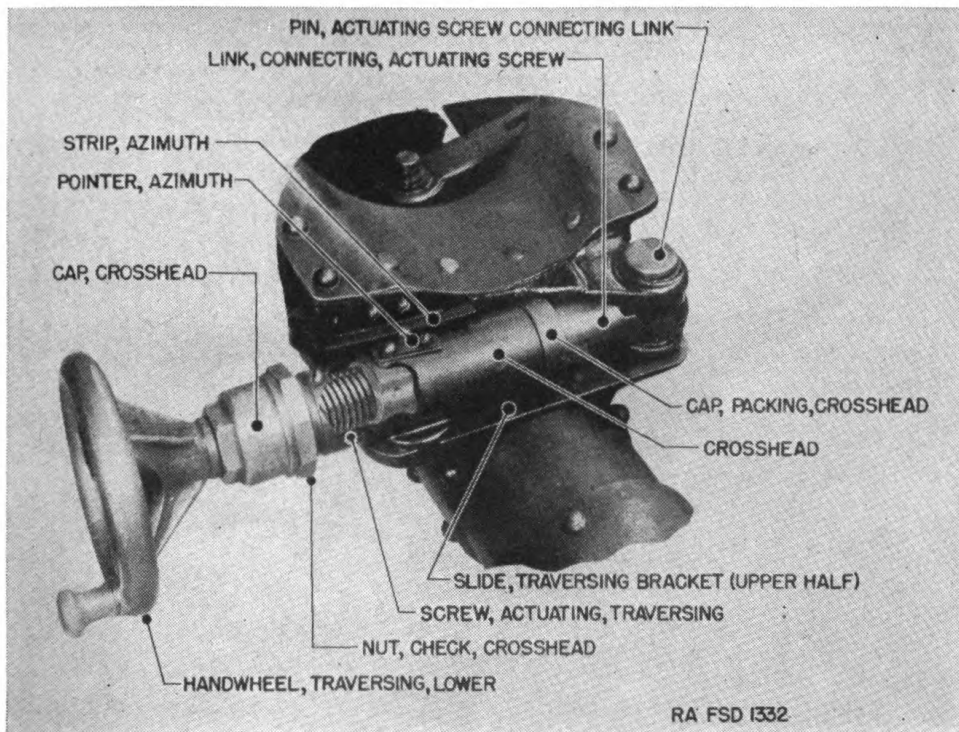


FIGURE 10.—Gear, traversing (general arrangement).

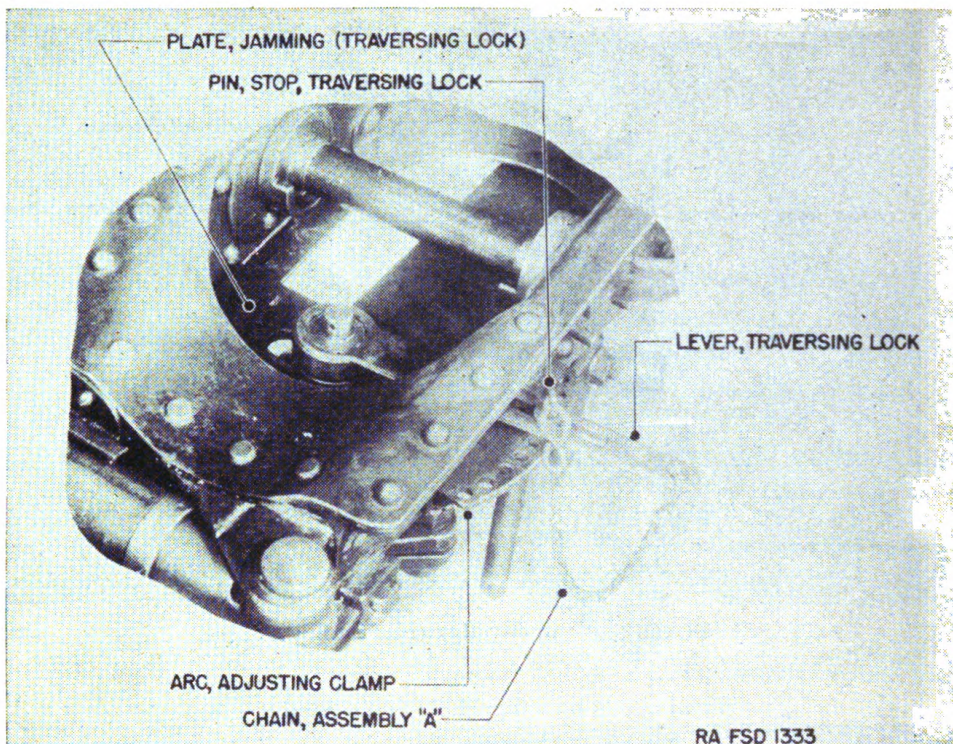


FIGURE 11.—Gear, traversing (clamping device).

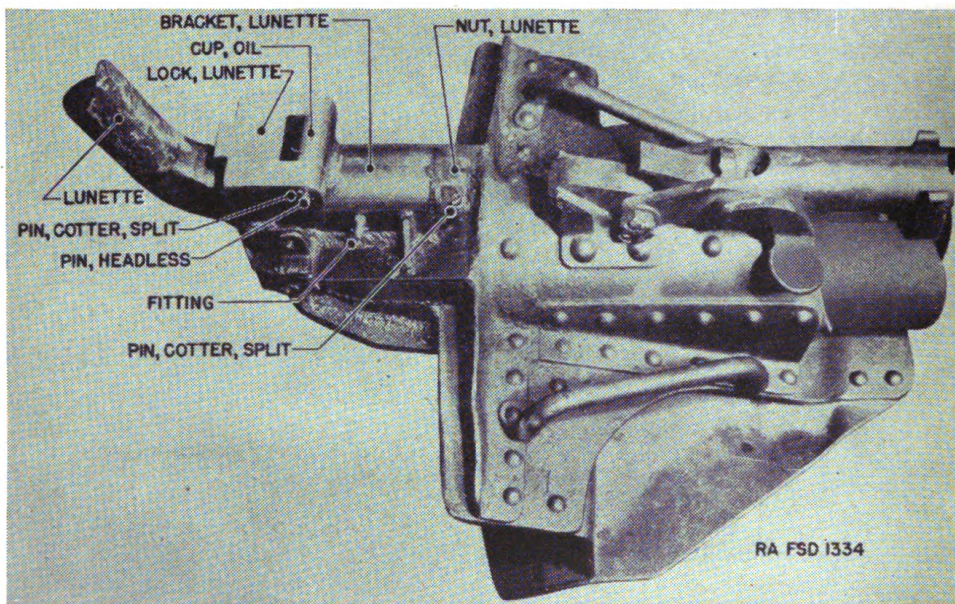


FIGURE 12.—Lunette (general arrangement), M1917A1.

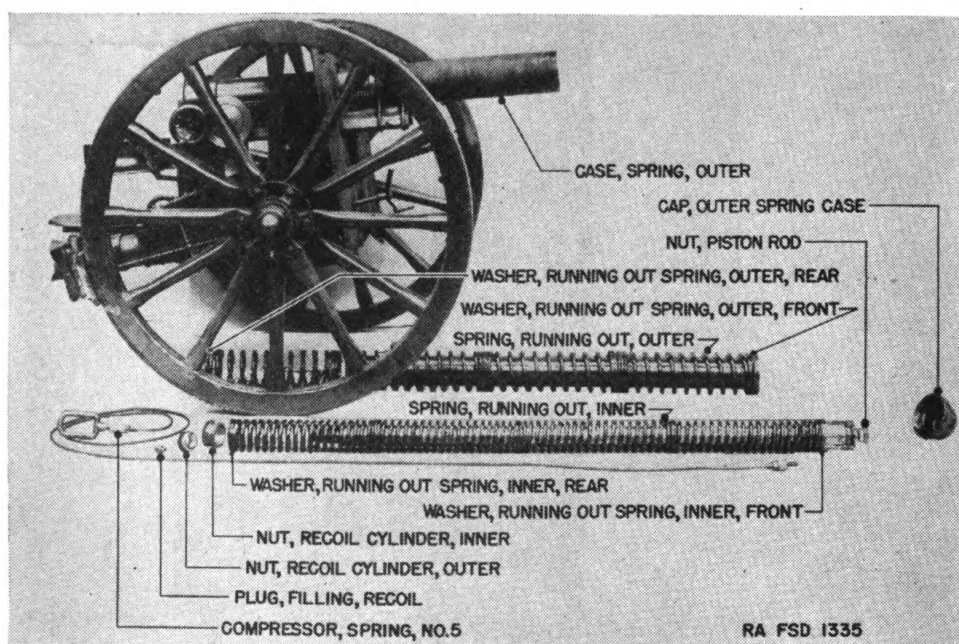


FIGURE 13.—Mechanism, recoil, without gravity tank.

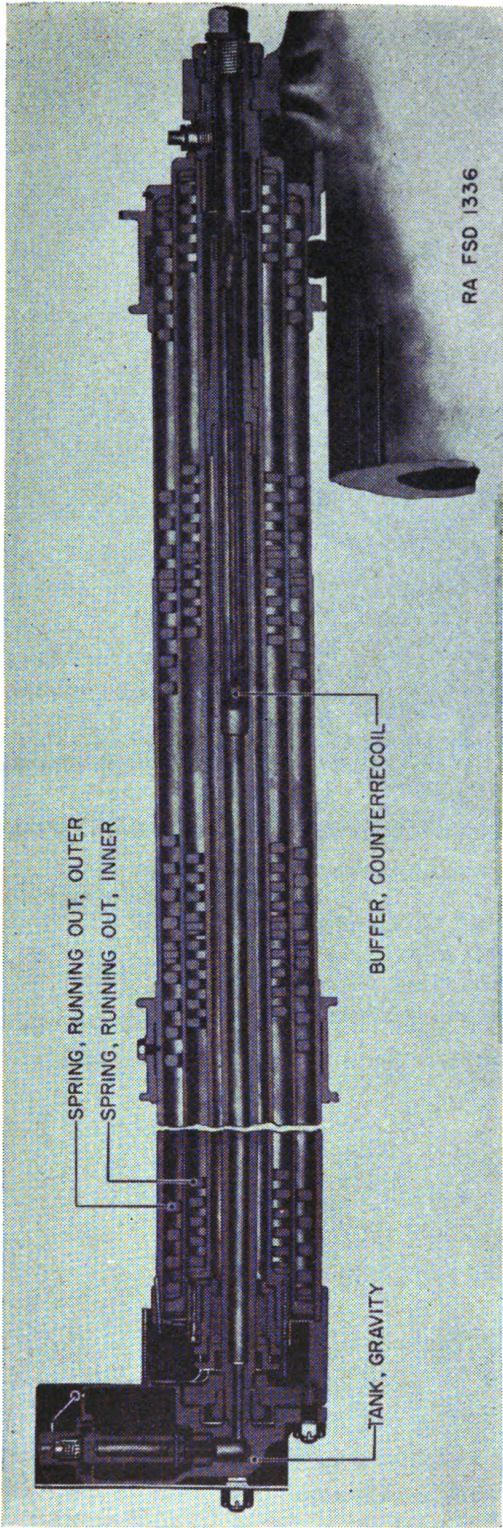


FIGURE 14.—Mechanism, recoil, with gravity tank.

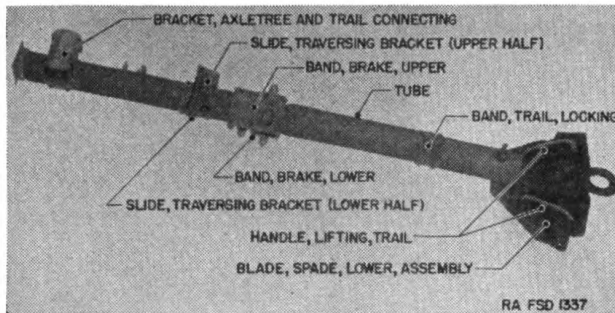


FIGURE 15.—Tube, trail, assembly, M1917.

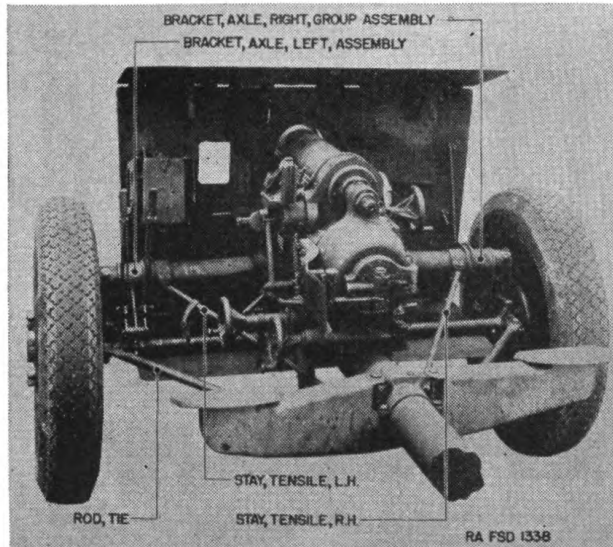


FIGURE 16.—Bracket, axle and tie rods, M1917A1.

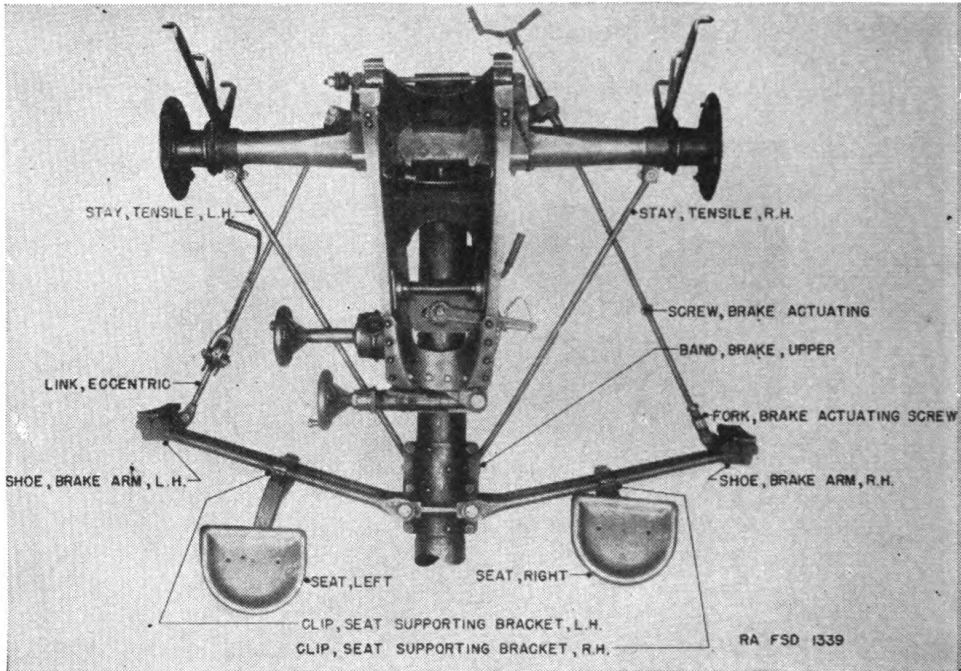


FIGURE 17.—Mechanism, brake, for carriage, M1917.

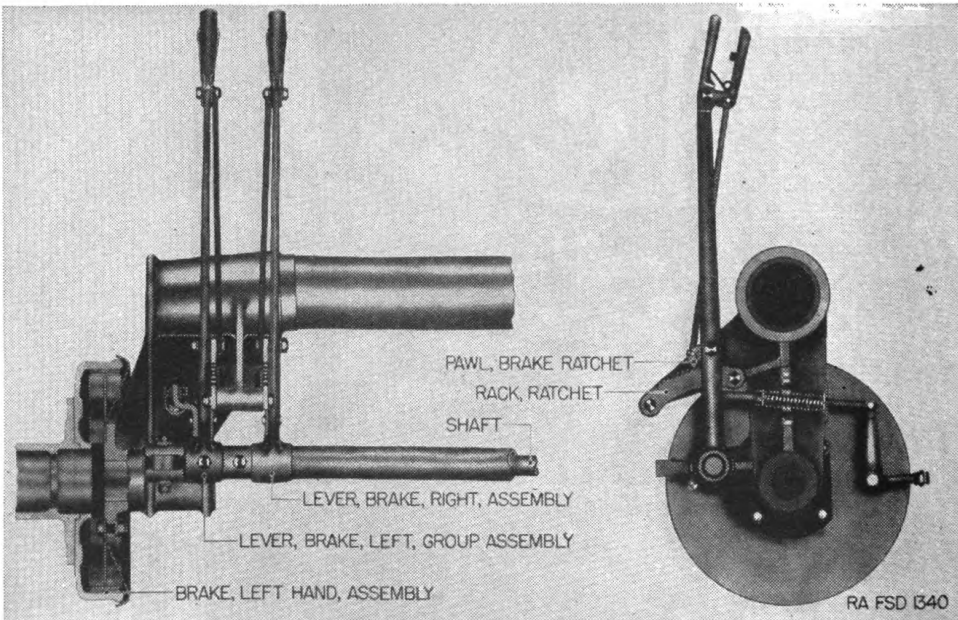


FIGURE 18.—Mechanism, brake, for carriage, M1917A1.

75-MM GUN AND CARRIAGE, M1917

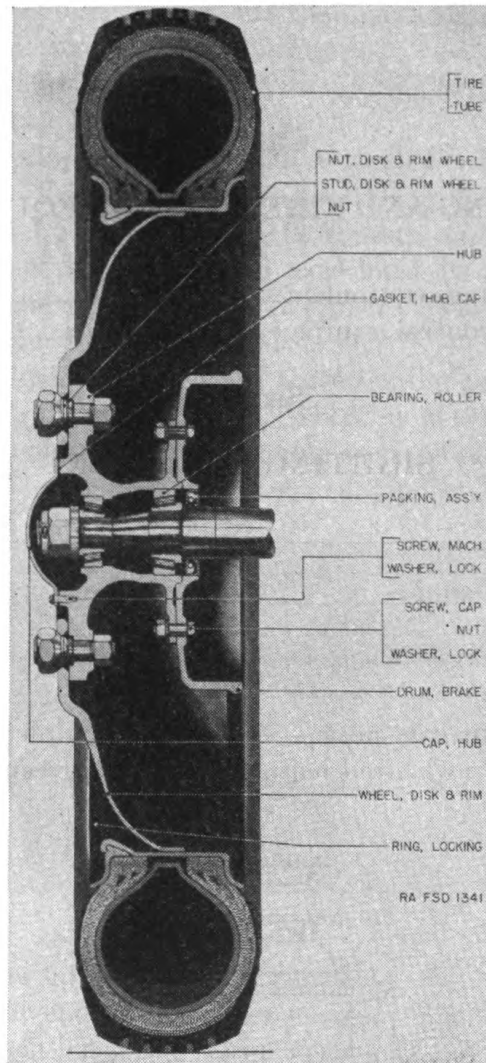


FIGURE 19.—Wheel, disk, and rim with brake and tire, assembly.

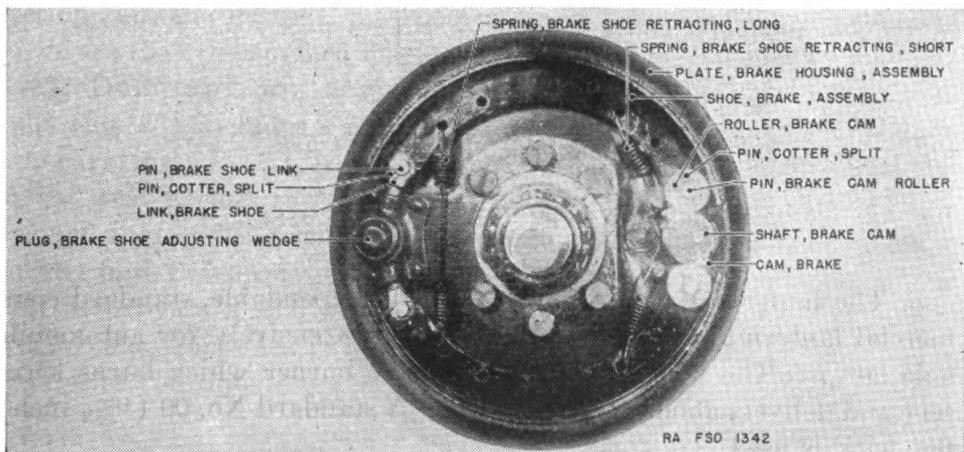


FIGURE 20.—Brake, assembly, M1917A1.

CHAPTER 3

SIGHTING AND FIRE CONTROL EQUIPMENT

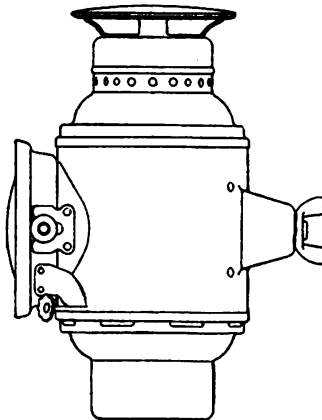
	Paragraphs
Section I. Sighting equipment.....	39-44
II. Fire control equipment.....	45-51

SECTION I

SIGHTING EQUIPMENT

	Paragraph
Lamp, aiming post.....	39
Post, aiming, M1.....	40
Quadrant, gunner's, M1918.....	41
Sight, bore.....	42
Sight, rocking bar, type F, and telescope, panoramic, M6.....	43
Target, testing.....	44

39. Lamp, aiming post.—This lamp, complete, is composed of two lanterns, M2 (with red lenses), one extra green lens, two shields, and two adapters.



RA FSD
491

FIGURE 21.—Aiming lantern, M2.

a. The lantern, M2 (fig. 21), is a small, dependable, standard commercial lantern of the type formerly used extensively for automobile side lamps. The lantern has a nonlosable burner which burns kerosene and delivers about 7 candlepower. A standard No. 00 ($1\frac{3}{32}$ -inch) flat wick is used.

b. The aiming lantern adapter fits the mounting device on the rear of the lantern and clamps to the aiming post.

c. The shield snaps around the rim of the lens and serves as a hood to cut off stray light.

d. The lantern should be burned in a vertical position using only kerosene as fuel. Keep the wick trimmed and the lens clean. Do not turn the wick up so high that the lantern smokes. The top of the lantern becomes hot in use and care must be taken to have no combustible material in close proximity to it. When not in use keep the various parts in the chest provided.

40. Post, aiming, M1.—Two of these aiming posts are furnished with each 75-mm. gun and carriage, M1917 or M1917A1. Each aiming post (fig. 22) consists of two tubular sections each approximately 4 feet long. The lower section has a metal point for embedding in

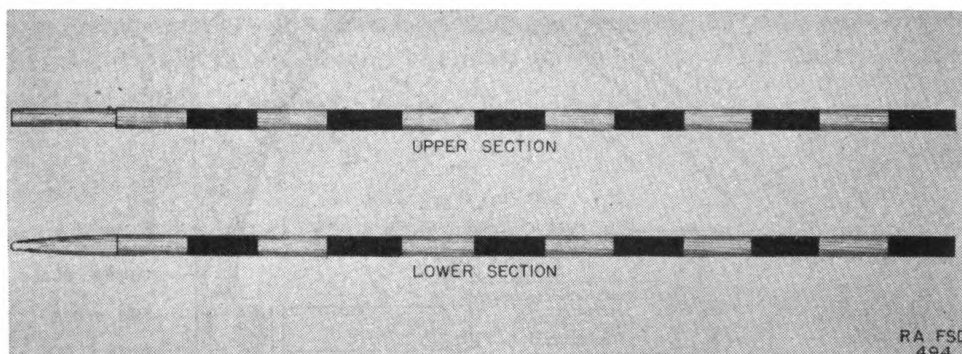


FIGURE 22.—Aiming post, M1.

the ground and the upper section is provided with a joint and catch fitting in the upper end of the lower section. The parts are painted with alternate 4-inch black and white bands. A canvas cover holding both sections is provided. Should it be necessary to drive the lower section into the ground, interpose a wood block or use other means to insure that the surface mating with the upper part is not injured.

41. Quadrant, gunner's, M1918.—*a. Description.*—This quadrant (fig. 23) includes a sector-shaped frame to which is pivoted an arm carrying a level. Notches on the frame engaging with a plunger in the arm permit rapid setting of the arm in 10-mil steps to the desired angle as indicated on the coarse scale. The arm is slightly curved and the level guide is arranged to be positioned along the arm to provide a fine indication supplementing that on the coarse scale. The frame has two reference surfaces, one used for elevations from 0 to 800 mils and the other from 800 to 1,600 mils. Separate

indications on opposite sides of the quadrant are used for the two different regions.

b. Operation.—(1) To measure elevation of piece, place proper reference surface of quadrant on leveling plates parallel to bore with associated arrow pointing in direction of fire. Clamp level guide to indicate zero on fine scale. Disengage plunger from notches in frame, lift arm, and slowly lower it until bubble is seen to pass through central point. Allow plunger to engage with notches and slide level guide along arm until level bubble is accurately centered. Face side of quadrant which bears arrow in use and read coarse and fine scales. The elevation of the piece in mils is equal

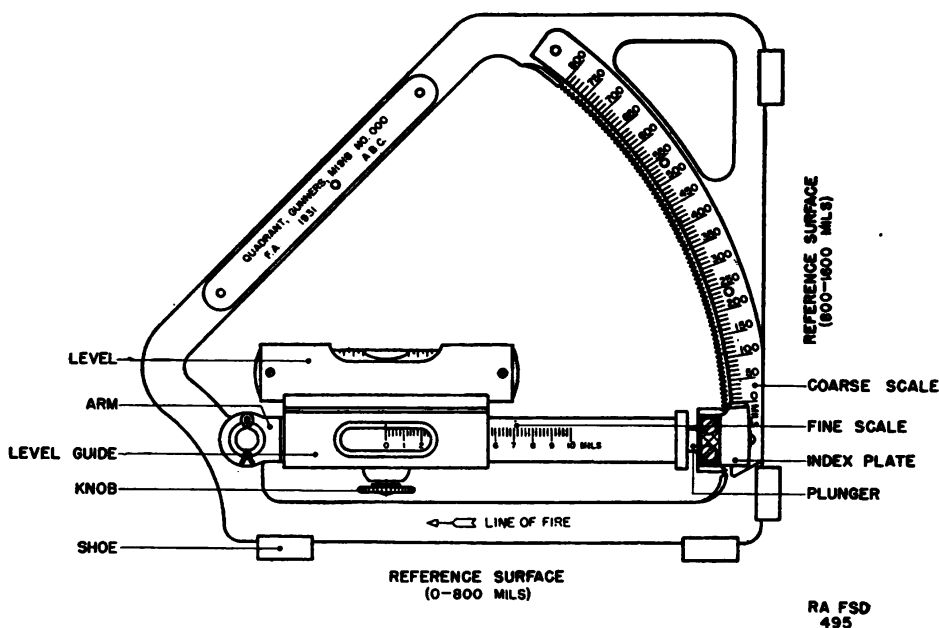


FIGURE 23.—Gunner's quadrant, M1918.

to the sum of the coarse and fine scale readings. Remove quadrant from piece before firing.

(2) To measure depression angles proceed as above but with the arrow pointed in the reverse direction.

(3) To lay piece to a given elevation, set scale and micrometer to required angle and place corresponding reference surface on leveling plates of piece. Elevate piece, then depress it until level bubble is centered. Remove quadrant from piece before firing.

c. Test and adjustment.—No adjustment of the quadrant by the using arm is permitted. The zero indication may be verified by setting the quadrant to zero elevation, elevating or depressing the piece to center the bubble, then turning the quadrant end for end.

If the bubble is not centered determine the elevation or depression angle necessary to center it. One-half of this angle is the error, and a corresponding correction should be applied to all subsequent indications in the 0—800 mil region.

d. Care and preservation.—(1) Refer to paragraph 51 for general instructions pertaining to the care and preservation of instruments.

(2) Exercise particular care to prevent burring, denting, or nicking of reference surfaces and of the notched portion of frame.

(3) Do not leave quadrant on piece when firing.

(4) When not in use, keep quadrant in chest provided, with shoes forming reference surfaces lightly greased with petrolatum.

42. Sight, bore.—The bore sight is used to indicate the direction of the axis of the bore of the gun and for alinement and verification of sights. Each bore sight is composed of a breech element and a muzzle element.

a. Description.—(1) The breech bore sight (fig. 24) is a disk which fits accurately in the breech chamber of the gun. The model of the gun for which it is to be used is engraved on the disk.

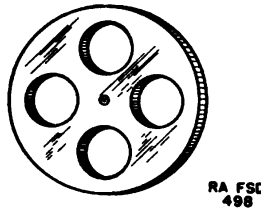


FIGURE 24.—Breech bore sight.

(2) The muzzle bore sight includes a quantity of black linen cord to be stretched tightly across the muzzle, vertically and horizontally in the score marks thereon, and a web belt to be buckled around the muzzle to hold the cord in place.

b. Operation.—With the two elements in place look through the aperture in the breech bore sight. The direction of the axis is indicated by the cord intersection.

c. Care and preservation.—Handle breech bore sight carefully to prevent occurrence of nicks and burs. Wind cord and web belt into a compact bundle when not in use.

43. Sight, rocking bar, type F, and telescope, panoramic, M6.—The rocking bar sight and panoramic telescope are used for aiming the gun in direction and for aiming or laying it in elevation and site. The rocking bar sight is arranged for independent setting of range and angle of site, and the panoramic telescope is arranged for traversing to any angle in azimuth. Included with the rocking

bar sight and panoramic telescope are a panoramic telescope carrier, rocking bar sight cover, spare sight chest, and teat wrench.

a. *Description of rocking bar sight, type F.*—The rocking bar sight (fig. 25) is pivoted at its forward end on a stud projecting from the left trunnion of the cradle at an angle with the horizontal of 1.5° to compensate for normal drift of the projectile. The rear end is fastened to the arc connecting bracket. This bracket is held by the elevating screw connecting rod so that no motion is imparted to the sight or panoramic telescope as the range is set off on the yards and degrees scale ring (range indicator) on the right side of the carriage. Angle of site indications are obtained by means of the angle of site level. The gun is laid in elevation so that the bubble of this level is centered. The angle of site setting is read on the angle of site scale and micrometer, the scale being graduated into 100-mil spaces numbered from 1 to 5, and the micrometer being graduated into 1-mil spaces numbered from 0 to 100. The setting is the sum of the values indi-

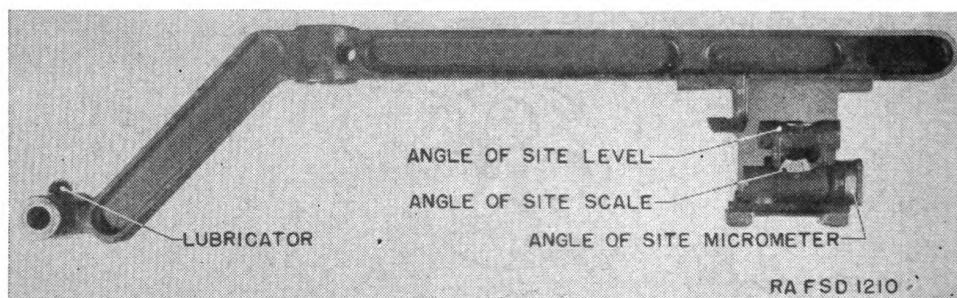


FIGURE 25.—Rocking bar sight, type F.

cated on the scale and micrometer. The 300-mil setting is the normal setting which corresponds to zero angle of site.

b. *Description of panoramic telescope, M6.*—The panoramic telescope, M6 (fig. 26), is a 4-power fixed focus telescope with a rotating head and azimuth mechanism by which the line of sight may be directed to any desired azimuth, and with a movable prism which permits the line of sight to be elevated or depressed through a limited angle as required to keep the aiming point within the field of view. The reticle contains a vertical and a horizontal cross line and a horizontal mil scale. The line of sight is elevated or depressed by means of the knob at the top, and coarse and fine index graduations are provided for the normal (zero elevation) position, but there is no provision for reading other angles of elevation. The azimuth scale is graduated in 100-mil steps, numbered progressively from 0 to 32 in two consecutive semicircles. Zero readings indicate the line of sight to be directly forward or directly

backward. The telescope is moved in azimuth by means of the azimuth worm knob which has a throw-out lever to permit disengagement for rapid motion when required. Indications of the azimuth micrometer index on the deflection knob, which is graduated in 1-mil steps, supplement those on the azimuth scale. The deflection knob is assem-

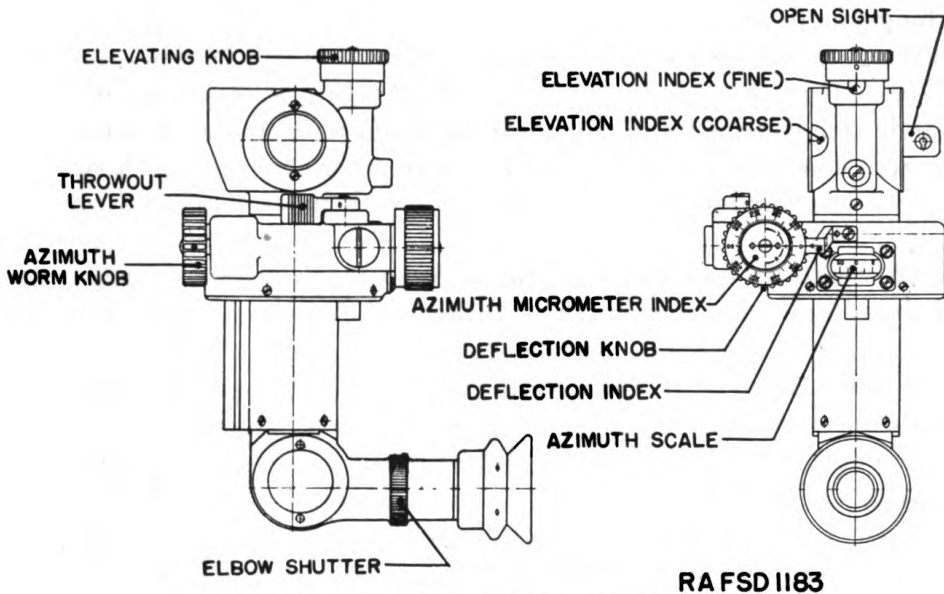


FIGURE 26.—Panoramic telescope, M6.

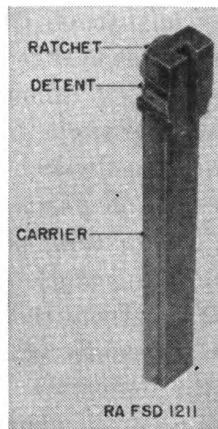


FIGURE 27.—Panoramic telescope carrier.

bled to a detent which causes a click at each 1-mil interval as the deflection knob is rotated. Rotation of the deflection knob does not change a deflection previously set, but changes the numerical value of the deflection. The T-lug on the telescope shank fits into the corresponding T-slot in the panoramic telescope carrier (fig. 27). The telescope

carrier may be raised in its seat to permit sighting over the main shield. A clamp screw is provided for holding it in its proper position.

c. Operation.—(1) *To place sight in operation.*—Remove rocking bar sight cover, clamp panoramic telescope carrier in bracket of rocking bar sight, remove panoramic telescope from its case, and mount it in T-slot of carrier. Clamp by means of ratchet, pressing on detent alongside to release ratchet. Before commencing operations, level carriage transversely as accurately as possible.

(2) *Direct fire.*—(a) By means of elevating knob at top of panoramic telescope, set rotating head of panoramic telescope to normal or zero elevation position. In this setting zero lines on both rotating head cover and elevating knob coincide with index marks on rotating head.

(b) Set off elevation corresponding to target range on yards and degrees scale ring, using upper elevating handwheel on right side of carriage.

(c) By means of azimuth worm knob set azimuth scale of panoramic telescope to zero.

(d) Turn deflection knob in proper direction, as indicated by right (R) and left (L) index arrows and their associated scales, until desired deflection correction is indicated against deflection index, then bring arrow of azimuth micrometer index to zero graduation of deflection knob.

(e) Operate traversing handwheel and lower elevating handwheel until reticle cross lines fall on target. Use open sight on side of rotating head to secure approximate direction.

(3) *Indirect fire.*—(a) Set angle of site scale and micrometer to desired setting corresponding to angle of site to target.

(b) Rotate upper elevating handwheel until elevation corresponding to target range is indicated on yards and degrees scale ring.

(c) By means of azimuth worm knob, set azimuth scale and azimuth micrometer index to indicate firing angle. (Firing angle is the horizontal clockwise angle measured from the target to the aiming point whose apex is at the piece.) Small corrections are applied before setting azimuth by setting the deflection knob against the correction index to indicate the correction angle. If desired, the correction angle can be included with the firing angle, in which case, the deflection knob is set to zero. Use throw-out lever for rapid setting when necessary to accomplish large movements of azimuth scale.

(d) Operate lower elevating handwheel until bubble is centered in angle of site level vial.

(e) Operate traversing handwheel until vertical cross line of reticle intersects aiming point. Use open sight on side of rotating head to

secure approximate direction and operate elevating knob of panoramic telescope if necessary to bring aiming point into field of view.

(4) *Operation in darkness.*—A window located under the elbow shutter of the panoramic telescope permits illumination of the reticle cross lines using an external light source.

(5) *To prepare sight for traveling.*—Remove panoramic telescope from rocking bar sight and secure it in case on carriage shield. Cover rocking bar sight with canvas cover provided.

(6) *Use of spare sight chest.*—The spare sight chest furnished each firing battery contains a panoramic telescope and gunner's quadrant which are for use in field replacement of defective instruments.

d. Tests and adjustments.—Before any adjustment or alinement of sights is attempted the carriage must be placed on a firm, hard, level base and leveled transversely. The gunner's quadrant is used in this leveling operation and in subsequent leveling operations.

(1) *Verification and adjustment of rocking bar sight.*—(a) Clamp panoramic telescope carrier in its bracket. Set gunner's quadrant to indicate 1600 mils, place it against exposed face of carrier, and operate lower elevating handwheel to center level bubble in gunner's quadrant. Transfer quadrant to level seat on right side of breech ring and level gun by means of upper elevating handwheel. The yards and degrees scale ring should then read zero. If it does not, loosen jamming plate (see par. 21), turn scale ring to zero by hand, and reclamp.

(b) Without disturbing the above settings, operate angle of site micrometer of rocking bar sight until level bubble is centered. The indication should be normal (300 mils). If not, and if the difference is small, loosen screw inside hub of angle of site micrometer and slip micrometer until its zero is opposite index, then tighten screw. If difference is large, so that the 3 of the scale does not agree with index, turn sight in for repair.

(2) *Verification and adjustment of panoramic telescope.*—The panoramic telescope is alined by bore sighting, using the testing target or a well-defined point at least 500 yards distant. The use of the testing target for horizontal collimation is preferred where possible and is described below. When using the testing target note that a vertical line 8 inches to the left of the bore target marks the position of the panoramic telescope (the target 14 inches to the left and above the bore target marks the position of the sight bar formerly used with the rocking bar sight).

(a) Open breech and secure bore sights in breech and on muzzle. Level bore of gun by setting range indicator and angle of site level to normal (zero elevation) position. Place testing target in position

about 54 yards from gun and at same level so that target is accurately alined when viewed through bore sights. With panoramic telescope mounted in its carrier, set azimuth and deflection of panoramic telescope at zero. The vertical line of the panoramic telescope reticle should then coincide with the vertical line of the testing target which marks the position of the panoramic telescope. Failure to coincide indicates that the azimuth micrometer index is out of adjustment. Rotate azimuth worm knob of panoramic telescope until vertical line is in correct position. Loosen locking screw at center of micrometer index and adjust index, using teat wrench provided, until arrow is in line with zero of deflection knob, then tighten locking screw.

(b) Lay gun accurately by bore sighting on some well-defined point at least 500 yards distant. By means of elevating knob at top of panoramic telescope, set rotating head of panoramic telescope to normal (zero elevation) position. The horizontal line of panoramic telescope reticle should then coincide with distant point. Failure to coincide indicates that the elevating knob is out of adjustment. Rotate elevating knob until horizontal line is in correct position. Loosen locking screw at center of knob and turn knob until zero is in line with index, then tighten locking screw. Do not lift knob during this adjustment, as such action may cause stop rings within knob to become disarranged.

(c) If azimuth scale and micrometer index do not both indicate zero simultaneously or if coarse and fine elevation indexes do not indicate simultaneously, turn sight in for repair.

(d) After the panoramic telescope is adjusted it should be submitted to the following test for accuracy at extreme elevation and azimuth:

1. With carriage level and gun and panoramic telescope at zero elevation and deflection, see that line of sight and axis of bore prolonged strike testing target at proper points.
2. Elevate gun to its maximum elevation without altering elevation of sight. As the elevation of the gun is altered, the line of sight should follow the vertical line of the testing target.
3. Bring gun back to level and traverse it to its extreme position. As the deflection is altered the line of sight should follow the horizontal line of the testing target.

e. Care and preservation.—(1) Refer to paragraph 51 for general instructions pertaining to the care and preservation of instruments.

(2) Keep mounting lugs and slots of panoramic telescope, panoramic telescope carrier, and bracket clean and lightly coated with petrolatum.

(3) Do not attempt to force rotation of any of knobs beyond their limits.

(4) Lubricate forward bearing of rocking bar sight at occasional intervals using a small quantity of neutral oil. Remove lubricator screw for the purpose and replace after oiling.

44. Target, testing.—A testing target is used during the bore sighting operation for the alinement of sights and subcaliber equipment with the axis of the bore of the piece. Four testing targets in an envelope are provided. The aiming points, corresponding to the axis of the bore of the gun and the axis of the sight, are plainly designated. Subcaliber equipment, when used, is inserted in the chamber of the gun and hence is alined with the gun aiming point. It is essential that the target be positioned vertically and in a vertical plane when in use.

SECTION II

FIRE CONTROL EQUIPMENT

	Paragraph
Circle, aiming, M1-----	45
Compass, prismatic, M1918 (Sperry)-----	46
Finder, range, 1-meter base, M1916-----	47
Setter, fuze, bracket, M1916-----	48
Setter, fuze, hand, M1912-----	49
Telescope, BC, M1915-----	50
Care and preservation-----	51

45. Circle, aiming, M1.—*a. Description.*—This instrument (fig. 28) is used for measuring angles in azimuth and site and for general topographical work. It includes a 4-power telescope with a laterally and vertically graduated reticle, two levels, a declinator, elevating, orienting, and azimuth mechanisms, and azimuth scales and micrometers. Azimuth indications are in mils, numbered to correspond to the scale indications of other instruments commonly used with the aiming circle. No scale other than that on the reticle is provided for vertical angles. The instrument is furnished complete with tripod and carrying case.

b. Description of instrument light.—All aiming circles, M1, are being equipped with the instrument light, M2, which includes a battery case connected by flexible cords to a reticle unit and a finger light. The battery case, containing one flashlight cell, is arranged to be clamped to a tripod leg and has a switch controlling both lamps simultaneously. The reticle unit snaps in place in a dovetailed slot over the reticle illuminating window. The finger light has a soft rubber housing and is held in a spring clip on the battery case when

not in use. The aiming circle carrying case is being modified to permit storage of the flashlight cell separately from the battery case.

c. Operation.—(1) To set up instrument, clamp tripod legs at desired length and embed them firmly in the ground. Clamp sliding support of tripod at desired height. Level instrument using circular level and ball and socket joint. Focus telescope as required, using sleeve on eyepiece.

(2) To orient instrument, either a datum point of known azimuth or magnetic bearings may be used.

(a) To orient on a datum point of known azimuth, set main azimuth scale (100-mil steps) and micrometer (1-mil steps) to azimuth of

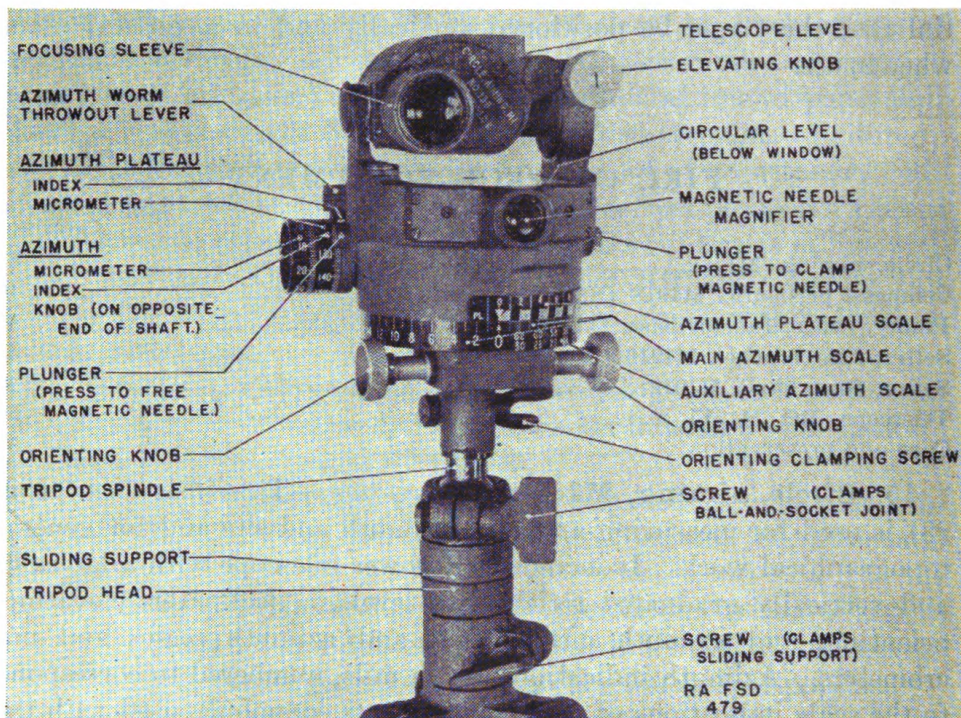


FIGURE 28.—Aiming circle, M1, without instrument light.

datum point and turn one of orienting knobs (the instrument may also be relocated on the tripod spindle using the orienting clamping screw for large angular changes) until datum point appears on vertical cross line of reticle. The telescope may be elevated or depressed as required to bring point in field of view.

(b) To orient on magnetic north, set main azimuth scale and micrometer to indicate zero. Press plunger releasing magnetic needle and turn one of orienting knobs (the instrument may also be relocated on the tripod spindle using the orienting clamping screw for large

angular changes) until the north seeking (knife edge) end of magnetic needle appears approximately opposite N index at front of instrument, then refine setting so that the south seeking (rectangular) end of needle is centered in reticle, viewed through magnifier. The instrument will then indicate magnetic azimuths.

(c) To orient on grid north, proceed as for magnetic north but set azimuth to magnetic declination of locality (subtracting west declinations from 6,400 mils) instead of to zero. The instrument will then indicate grid azimuths.

(d) When orientation by magnetic bearings has been completed, press red plunger to clamp magnetic needle.

(3) To read angle of site, rotate elevating knob so that bubble of telescope level is centered. The angle of site of an object is then indicated by its position on the graduations at 5-mil intervals along the vertical cross line of the reticle. Angles of site thus measured are limited to ± 85 mils and no other indicating means are provided.

(4) To read azimuth, bring object on vertical cross line of reticle using azimuth knob. The throw-out lever may be depressed for making large azimuth changes rapidly. The azimuth indications of this instrument may be read either directly in mils or in terms of the indications of other instruments commonly used in connection therewith.

(a) Azimuths from 0 to 6,400 mils are read directly on the azimuth scale, using the main (upper) graduations for values from 3,200 mils up. Indications on this scale are at 100-mil intervals and are supplemented by those on the azimuth micrometer which is graduated at 1-mil intervals.

(b) Angular indications corresponding to those of the panoramic telescope (0-3,200, 0-3,200 mil scales) are similarly read, using the auxiliary (lower) graduations for azimuths over 3,200 mils.

(c) Small angles may be measured along the horizontal cross line of the reticle which is graduated at 5-mil intervals.

(d) The azimuth plateau scale and micrometer are for use with the French sight, M1901.

(5) To prepare instrument for traveling, place it in carrying case provided. Do not remove instrument from tripod.

d. Tests and adjustments.—(1) The azimuth and plateau micrometers should read 0 and 100, respectively, when the azimuth scale indicates zero. Three screws in the end of the azimuth micrometer may be temporarily loosened for this adjustment.

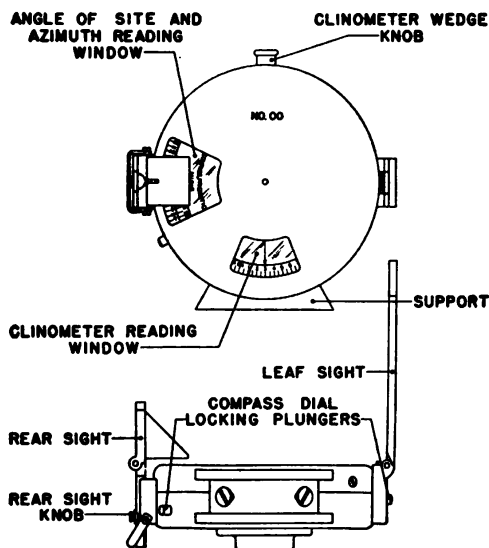
(2) The telescope level should indicate the line of sight determined by the center of the reticle to be horizontal. This may be verified by sighting on a distant point at the same level as the telescope, the error,

if any, being read on the reticle. No corrective adjustment by the using arm is permitted. A celluloid strip is provided on the front of the instrument on which any correction should be recorded.

(3) To check the accuracy of the declinator it is necessary to set up the instrument in a position not subject to local magnetic attraction and sight on one or (preferably) more points of known azimuth. The average error should be noted and the necessary correction recorded on the celluloid strip. No adjustment by the using arm is permitted.

e. Care and preservation.—(1) Refer to paragraph 51 for general instructions pertaining to the care and preservation of instruments.

(2) Exposed moving parts should be oiled occasionally with a small quantity of neutral oil. Interior parts are not to be lubricated by the



RA FSD
480

FIGURE 29.—Prismatic compass, M1918.

using arm. Keep excessive lubricant that seeps from mechanisms wiped off to prevent accumulation of dust and grit.

(3) When storing aiming circles equipped with instrument lights, remove flashlight cell from battery case and place it in compartment of aiming circle carrying case.

46. Compass, prismatic, M1918 (Sperry).—This instrument (fig. 29) is used for measuring angles of site, clinometer angles, and magnetic azimuths.

a. Description.—This instrument is furnished complete with a leather carrying case and without tripod. The instrument includes a compass dial (green) carrying a magnetic needle and azimuth scales,

a weighted clinometer dial (white), and a sighting system whereby angular indications may be read while observing the object.

b. Operation.—(1) To measure angles of site, raise leaf sight and rear sight. Pull out the clinometer wedge knob to permit free rotation of clinometer dial. Focus rear sight on clinometer (white) dial, sliding sight as required and clamping it in position with rear sight knob. Hold instrument with dials in a vertical plane, look through niche in rear sight and elevate or depress instrument until object observed is in line with horizontal central vane of leaf sight. The angle of site reflected in the rear sight prism will also be visible in the center of the field of view. The angle of site scale (the outer scale on the clinometer dial) is graduated at 5-mil intervals and numbered at 100-mil intervals. The 50-mil points are also marked. A 300-mil indication corresponds to a level line of sight as on the corresponding scales of the rocking bar sight. The clinometer wedge knob may be partially depressed to damp out oscillations. It must not be depressed when taking the reading.

(2) To measure azimuths, first operate instrument in angle of site until compass (green) dial is exposed at rear sight by cutaway portion of clinometer (white) dial. Depress clinometer wedge knob. Raise leaf sight and rear sight. Focus rear sight on compass (green) dial. Hold instrument in the hand or support it on a convenient nonmagnetic body, look through niche in rear sight and rotate instrument in azimuth until object observed is in line with vertical central vane of leaf sight. The magnetic azimuth reflected in the rear sight prism will also be visible in the center of the field of view. The compass dial is graduated at 10-mil intervals and numbered at 100-mil intervals. Additional numbering is provided in the 3,200–6,400-mil half of the scale to correspond to the numbering on the azimuth scale of the panoramic telescope which is graduated 0–3,200 mils in this range. To damp out oscillations of the compass dial, gently depress one of locking plungers. Plungers must not be in the depressed position when taking the azimuth reading.

(3) To use instrument as a clinometer, pull out clinometer wedge knob and stand instrument, prism to rear, on its support, on a straight portion of piece which is parallel to bore. The reading of the clinometer scale, read opposite an etched line on the clinometer reading window, is the elevation of the piece. The clinometer scale is graduated at 10-mil intervals and numbered at 100-mil intervals. A 300-mil reading indicates the bore of the piece to be level. The sights should not be raised when using the instrument only as a clinometer. The clinometer wedge knob may be partially depressed to damp out oscillations. It must not be depressed when taking the reading.

(4) To prepare instrument for traveling, push in clinometer wedge knob (clamping clinometer dial) and turn leaf sight down (clamping compass dial). Lower and fold back rear sight, securing it in place with catch. Place instrument in leather case provided.

c. Tests and adjustments.—Accuracy of the azimuth and angle of site indications may be checked by sighting on datum points of known azimuth and elevation. When placed on a flat level surface the clinometer should indicate 300. No adjustment by the using arm is permitted.

d. Care and preservation.—(1) Refer to paragraph 51 for general instructions pertaining to the care and preservation of instruments.

(2) When not in use keep leaf sight down to clamp compass dial, and clinometer wedge knob depressed to clamp clinometer dial, thus preventing injury to and excessive wear of their respective pivots.

(3) Observe particular care to prevent bending of leaf sight parts.

(4) No lubrication of the instrument is required.

47. Finder, range, 1-meter base, M1916.—This instrument (figs. 30 and 31) is used primarily for measuring distance by triangulation. Indications of azimuth and angle of site are also provided.

a. Description.—The instrument includes an internal 1-meter base line, a 15-power optical system with two objectives and a common eyepiece of the coincidence type, and a scale on which the distance is indicated. It is furnished complete with mount and tripod. The necessary carrying cases and adjusting equipment are also provided. The mount positions the line of sight of the range finder in elevation and azimuth and provides a hinge joint for placing the base line axis of the instrument in either a vertical or a horizontal position. Angle of site and azimuth scales and micrometers are provided on the mount.

b. Operation.—(1) To set up instrument, securely clamp tripod legs at desired length, embed them firmly in the ground and tighten the leg clamping levers. It is necessary that the azimuth scale be in a substantially horizontal plane. Place range finder on mount and latch it in position. Position longitudinal axis horizontally and clamp with hinge clamping handle. Procedure for a vertical base line is described in (5) below.

(2) To prepare optical system for use, rotate end box sleeves uncovering both windows. Set ray filter lever to the proper position. No filter at all may be used, or the amber filter (for exceptionally bright daylight or reflection of sun over water) or the smoked filter (for observation near the sun or into direct rays of a searchlight) may be employed as required. Focus eyepiece by rotating diopter scale to produce a clear image. If the operator knows the value for his own eye, the setting may be made directly on the scale.

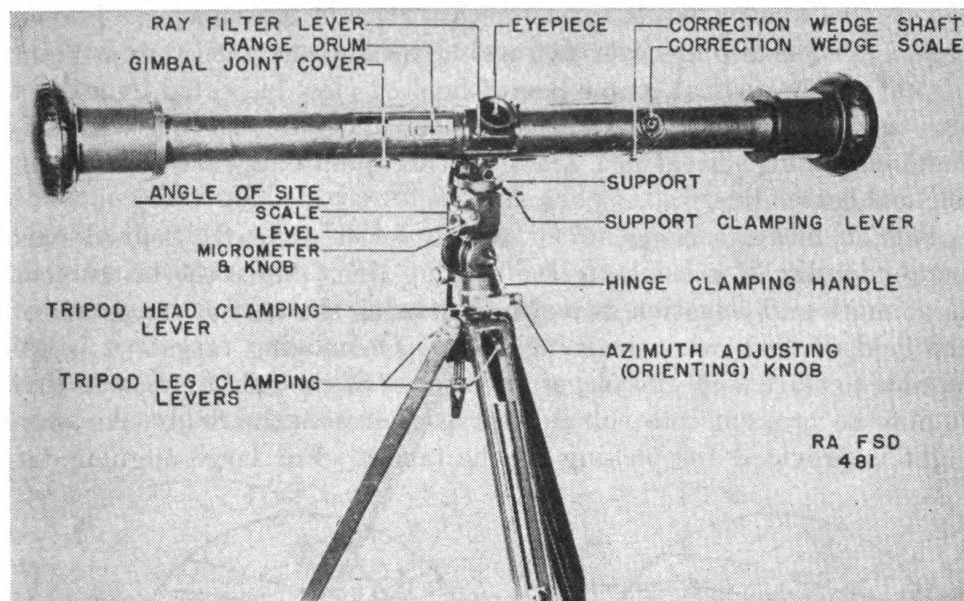


FIGURE 30.—Range finder, M1916, 1-meter base (rear view).

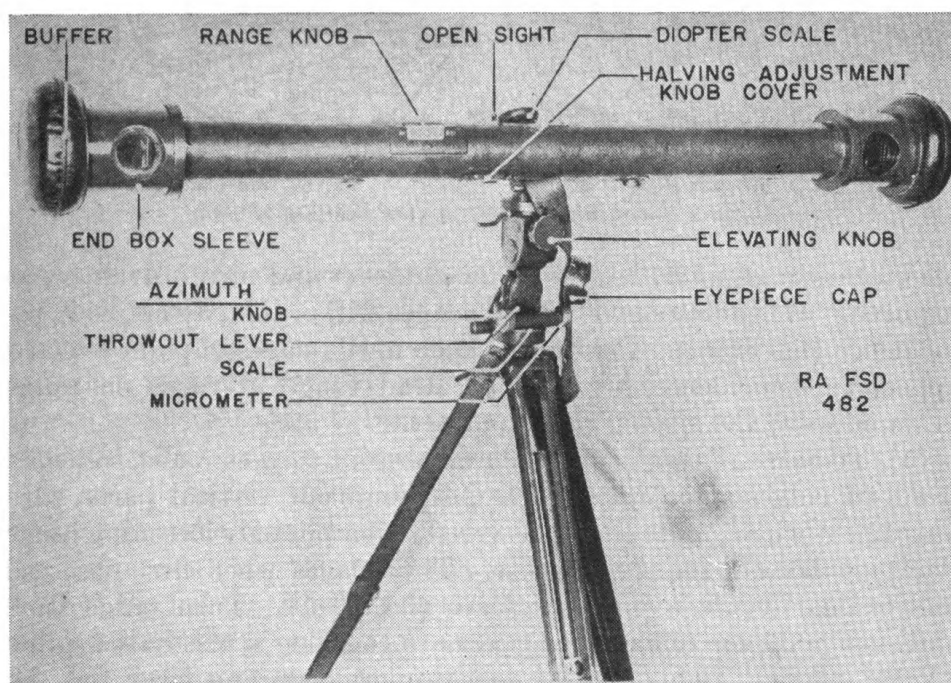
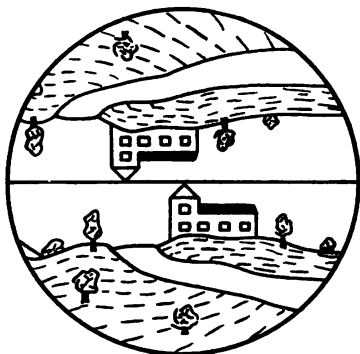


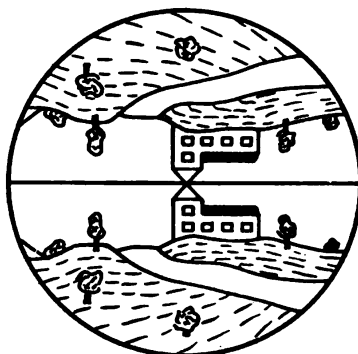
FIGURE 31.—Range finder, M1916, 1-meter base (front view).

(3) To orient instrument, select a datum point of known azimuth. Set this value of azimuth on azimuth scale and micrometer. Loosen tripod head clamping lever and swing instrument until datum point appears near vertical center line of field of view indicated by a short line in lower field of view. Clamp lever and refine setting with azimuth adjusting orienting) knob so that point appears exactly on vertical center line.

(4) To measure range of an object, select a clearly defined part perpendicular, if possible, to the halving line. Move the instrument in azimuth and elevation as required to bring the part at the center of the field of view when in coincidence. On moving targets it is advisable to start with the target at the edge of the field of view so that it may be brought into coincidence as it crosses the field. An open sight is provided for picking up the target. For large angular dis-



① Not in coincidence.



② In coincidence.

FIGURE 32.—Range finder field of view (horizontal base).

RA FSD
483

placements in azimuth, depress throw-out lever and turn instrument as required. When first observed the images will ordinarily not be in coincidence (fig. 32①). Turn range knob until images of point selected appear in coincidence (fig. 32②). Read range in yards on range drum opposite the sliding range pointer.

(5) To measure range of horizontal objects, such as roads, trenches, crests of ridges, etc., which have no prominent vertical parts, turn instrument with longitudinal axis vertical, temporarily loosening hinge clamping handle for the purpose. The images when first observed will ordinarily not be in coincidence (fig. 33①). Turn range knob until image of horizontal line appears to continue across halving line (A, fig. 33②). Temporarily lower support clamping lever for any necessary motion in elevation.

(6) To read angle of site, center level bubble using angle of site knob. The angle of site indication may then be read on the associated

scale (100-mil steps) and micrometer (1-mil steps). An indication of 300 mils corresponds to a horizontal line of sight. Angle of site can be read only when using the instrument with the longitudinal axis horizontal.

(7) To read azimuth, the azimuth scale (100-mil steps) and micrometer (1-mil steps) furnish the necessary indications. It is essential that the plane of the azimuth scale be substantially level and that the object be at the halving line for correct angular indications. Azimuth may be measured with the longitudinal axis either vertical or horizontal, but the instrument must be oriented separately for each position. Azimuths from 3,200 to 6,400 mils have an additional auxiliary scale reading from 0 to 3,200 mils for use with the panoramic telescope which is similarly graduated.

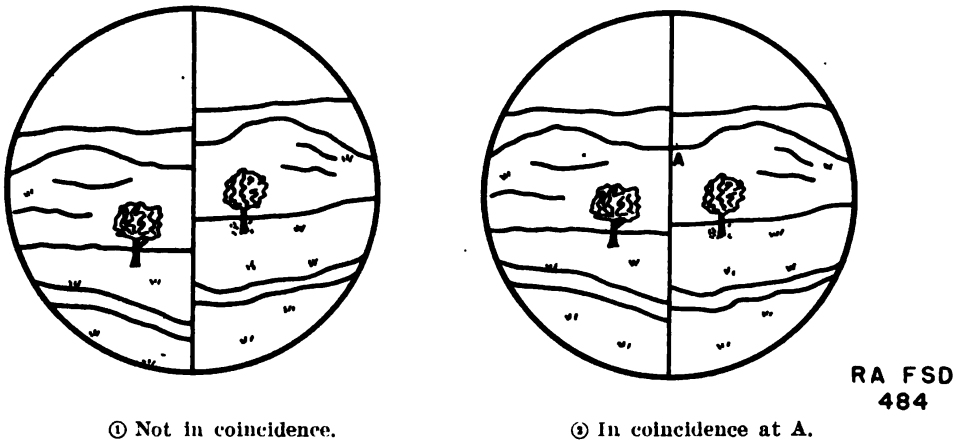


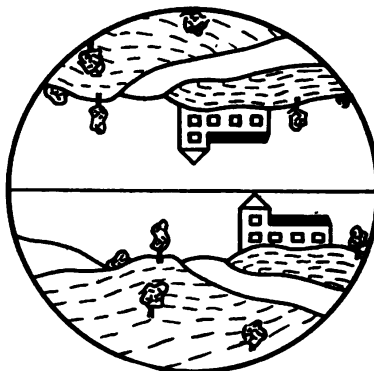
FIGURE 33.—Range finder field of view, vertical base.

(8) To prepare instrument for traveling, cover eyepiece, close end box sleeves and cover over range drum. Remove range finder from mount and place in case provided. Place mount and tripod in case provided, with elevating knob toward inside of case. It is not necessary to remove the mount from the tripod. Remove sight from adjusting lath, place lath in internal pocket of tripod carrying case, and sight in lid pocket. The latter pocket also contains the correction wedge key and a camel's-hair brush.

c. Tests and adjustments.—(1) *Halving line.*—Incorrect adjustment of the halving line is indicated by the failure of the corresponding points on the inverted and erect images to fall on the halving line (fig. 34). To correct halving, slide back cover exposing halving adjustment knob and rotate knob until corresponding point of each image touches halving line (as in fig. 32 ① and ②). A sharply

defined point at least 400 yards away must be used for this adjustment. Return cover to its original position when adjustment is completed.

(2) *Range indications.*—(a) To test instrument using a finite range, select a sharply defined object at a distance of 400 yards or more, the range of which is accurately known, and bring object into coincidence

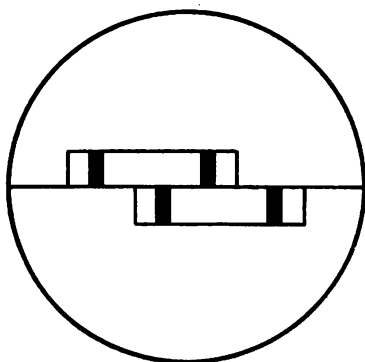


RA FSD
485

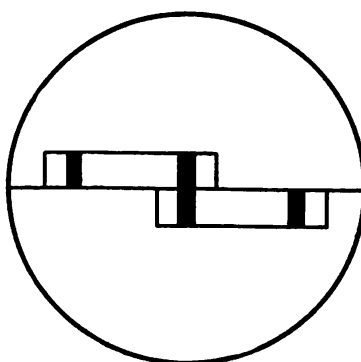
FIGURE 34.—Range finder field of view, incorrect halving.

in center of field of view (fig. 32 ②). If the range adjustment is correct, the known range should be indicated.

(b) To test using the moon or other celestial body (not the sun), proceed as for an object at finite range. Infinite range (∞) should be indicated.



① Incorrect alinement.



② Correct alinement.

RA FSD
486

FIGURE 35.—Range adjustment, infinity method.

(c) To test instrument by infinity method, prepare adjusting lath by inserting sight. Place adjusting lath in a horizontal position 125 yards or preferably more from instrument. Use sight on lath to insure perpendicularity to line of sight. Set range drum to indicate infinite range (∞). If the images appear alined as in figure 35 ②, the

adjustment is correct. Misalinement, such as is shown in figure 35① indicates the necessity for adjustment.

(d) To adjust the instrument in range, set range at known range or at infinity, depending on method of test employed, and bring images into correct relation using correction wedge key to turn correction wedge shaft. Note indication on correction wedge scale, repeat several times, and set scale to average of readings.

(e) It is essential that the adjusting lath, when used, be the one belonging with the particular instrument. The same serial number is provided on both.

(3) *Azimuth indications.*—Should the azimuth scale and micrometer fail to indicate zero simultaneously, the latter may be slipped around as required, temporarily loosening the clamping screw in the end.

(4) *Angle of site indications.*—Sight on a point at least 400 yards distant at the same level as the range finder. The angle of site indication should be normal (300 mils). Corrections for small errors may be applied by slipping the angle of site micrometer through the required angle, temporarily loosening the clamping screw in the end.

d. *Care and preservation.*—(1) Refer to paragraph 51 for general instructions pertaining to the care and preservation of instruments.

(2) The gimbal joint cover is not to be removed by the using arm.

(3) Keep cover over halving adjusting knob closed except when making an adjustment.

(4) Do not point range finder directly at the sun. This instrument contains a cemented prism which will be injured by such practice.

(5) Avoid striking or bumping instrument at ends when mounted as parts at center will thereby be subjected to excessive stress.

(6) Exposed moving parts of mount should be oiled occasionally using neutral oil. Interior parts of the mount and range finder are not to be lubricated by the using arm. Keep excess lubricant that seeps from mechanisms wiped off to prevent accumulation of dust and grit.

48. Setter, fuze, bracket, M1916.—This fuze setter (fig. 36) is used for setting powder train fuzes. It is furnished complete with a canvas cover and, where required, with a metal anchor.

a. *Operation.*—(1) Check to see that range ring corresponds to gun and ammunition in use. This information is engraved on the range ring.

(2) Using crank, set desired value of range opposite range index. By means of the corrector knob set desired value of correction opposite correction index. A setting of 30 corresponds to zero correction.

(3) Insert round, fuze foremost, into setter without regard to relative position of fuze pins and setter parts. With round pressed firmly into setter, rotate round manually in a clockwise direction until a stop is encountered.

(4) Leave round in setter until ready for use. Range or correction may be changed with the round in place, the round then being again turned clockwise as in the original setting operation. Remove round when ready for use without further rotation.

(5) To set a fuze to "safe," set range at S, correction at 30, and proceed as for other settings.

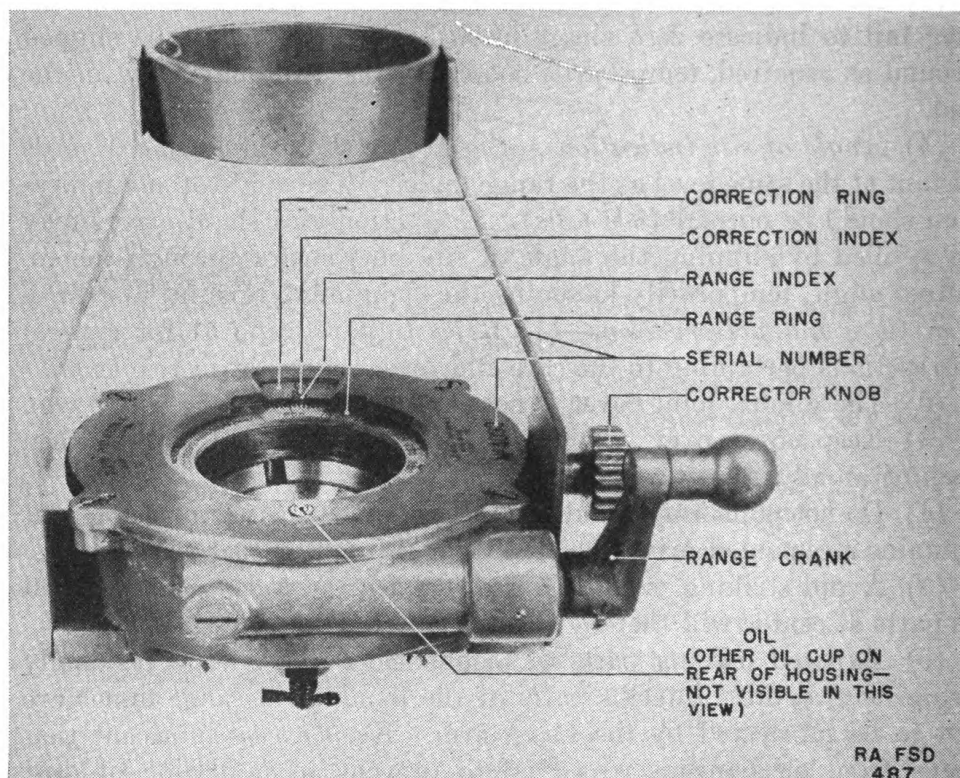


FIGURE 36.—Bracket fuze setter, M1916 (without anchor).

b. Tests and adjustments.—The accuracy of the fuze setter may be verified by comparing the values of range indicated on the range scale with those actually set on the fuze, at several different ranges. A correction may then be applied to minimize the error. No other adjustment by the using arm is permitted.

c. Care and preservation.—(1) Refer to paragraph 51 for general instructions pertaining to the care and preservation of instruments.

(2) Oil mechanism occasionally with neutral oil in the two oil cups provided. Set range to zero when oiling.

(3) Rotate round only in a clockwise direction. Incorrect settings and loosening of the fuze may result from failure to do so.

(4) Should the setter become clogged with sand or dirt so as to affect its operation, it is to be turned over to qualified ordnance personnel for cleaning.

(5) When not in use, protect setter with canvas cover provided.

49. Setter, fuze, hand, M1912.—This fuze setter (fig. 37) is a small portable device for setting powder train fuzes. It is furnished complete with a leather carrying case.

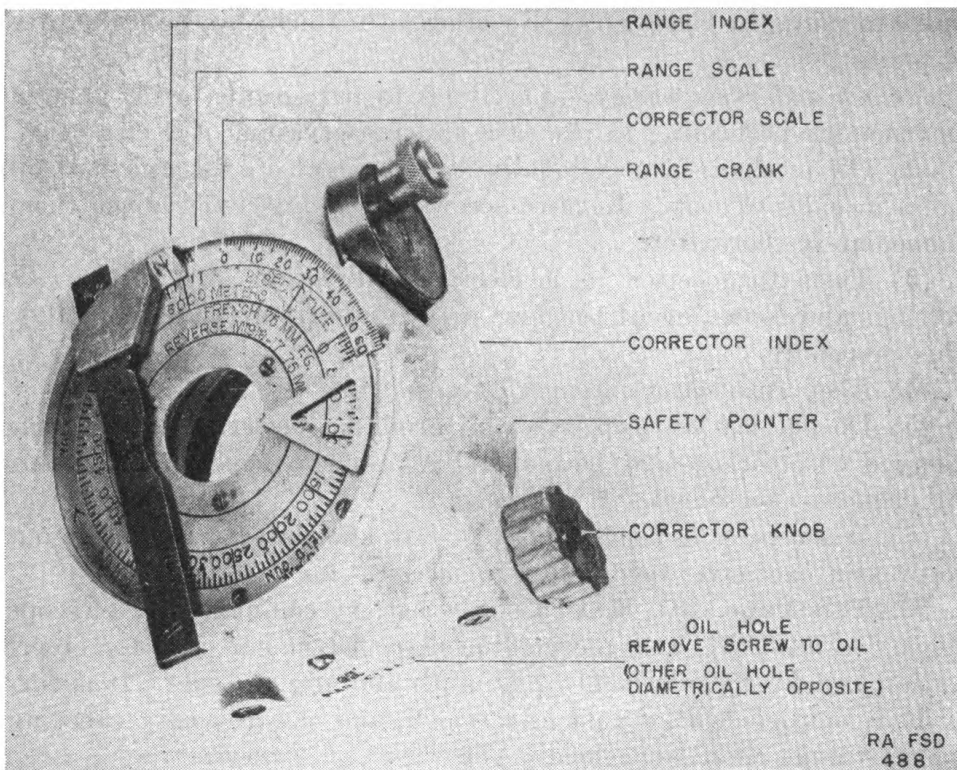


FIGURE 37.—Hand fuze setter, M1912.

NOTE.—All of these setters now in service have range scales graduated in yards.

a. Operation.—(1) Check to see that range scale corresponds to gun and ammunition in use. This information is engraved on the range scale.

(2) Push range index to its outermost position as shown in figure 37. Other positions of the index, originally intended for zone fire, are no longer used.

(3) Pull out knob of range crank and turn crank until desired range is indicated. By means of corrector knob, set any desired cor-

rection on correction scale. Zero correction corresponds to 30 on the scale.

(4) Place fuze setter over point of fuze and rotate setter in a clockwise direction (as indicated by arrow) until a stop is encountered, indicating completion of setting operation. Verify completion by noting that safety pointer falls opposite line on cap on fuze.

(5) Lift off fuze setter without further rotation.

b. Tests and adjustments.—The accuracy of the fuze setter may be verified by comparing the values of range indicated with those actually set, at several points. If necessary, set a correction of the proper value to minimize the errors. No other adjustment by the using arm is permitted.

c. Care and preservation.—(1) Refer to paragraph 51 for general instructions pertaining to the care and preservation of instruments.

(2) Oil mechanism occasionally with neutral oil through two oil holes in sides of case. Remove screws for oiling and replace them immediately thereafter.

(3) Turn fuze setter in a clockwise direction only. Incorrect settings and loosening of the fuze may result from failure to follow this procedure.

(4) Keep fuze setter in carrying case when not in use.

(5) Do not lay or drop setter on ground. Setters which become clogged with dirt so as to be inoperable are to be turned in for repair by ordnance personnel.

(6) When turning range crank, be sure knob is entirely pulled out to prevent excessive wear on detent mechanism.

50. Telescope, BC, M1915.—The battery commander's telescope (figs. 38 and 39) is a 10-power binocular instrument used for observation and for measurement of azimuth and angle of site. It is furnished complete with mount and tripod, and the necessary carrying cases, storage chest, and cleaning brushes.

a. Description.—(1) The telescopes are arranged so that they may be positioned vertically, as shown, or swung down horizontally so as to provide an accentuated stereoscopic effect.

(2) Modified instruments, designated M1915A1, will be equipped for reticle illumination and will be designed to receive the instrument light, M1. Illumination for such instruments may be supplied by flashlight until such time as the instrument light becomes available.

b. Operation.—(1) To set up instrument, remove tripod and mount from tripod carrying case, clamp tripod legs at the desired length, embed them firmly in the ground and tighten leg clamping levers. Remove telescope from its carrying case and place it on vertical

spindle extending from mount, depressing locking plunger and turning telescope until mating surfaces of telescope and mount engage properly, then releasing plunger. Level mount using circular level and ball and socket joint at bottom of mount and clamp with lever when level bubble is centered.

(2) To prepare telescope, remove caps from eyepieces and objectives. If required, place sunshades over objectives and amber filters over eyelenses. Sunshades and filters are carried in compartments

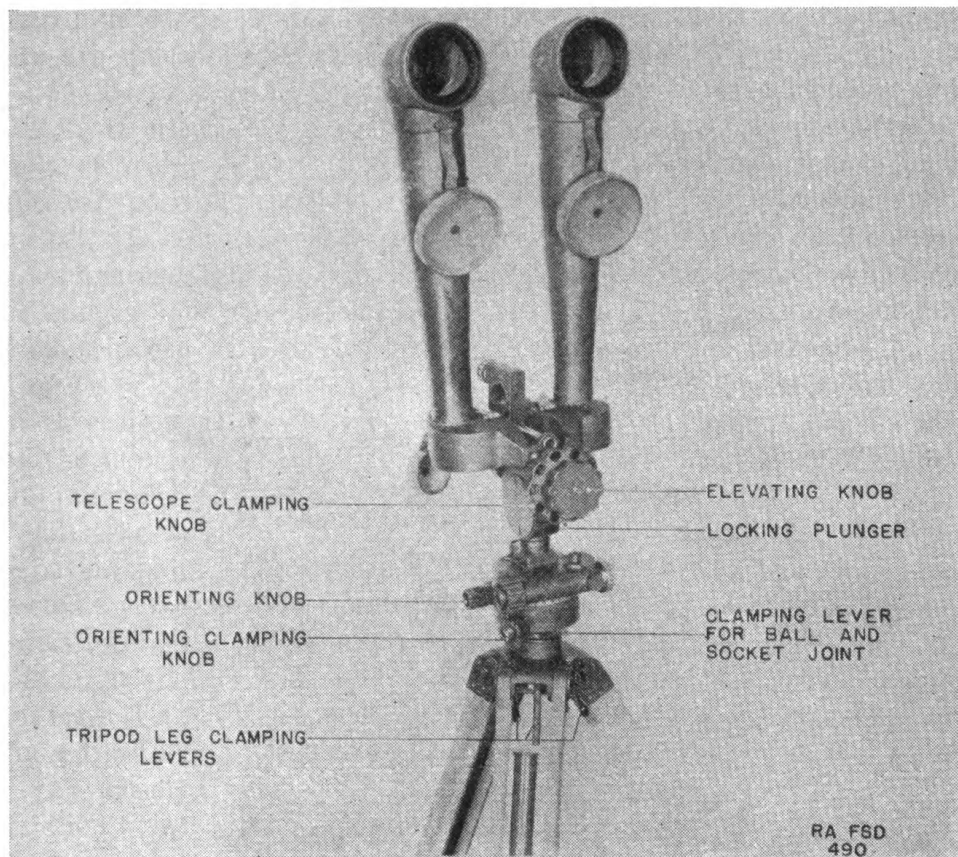


FIGURE 38.—Battery commander's telescope, M1915 (front view).

of the telescope case. Release telescope clamping knob and turn telescope to the vertical or horizontal position as required, at same time setting proper interpupillary distance in millimeters on associated scale and clamp in place. If the interpupillary distance for the observer is not known it may be found by observing the sky and moving the eyepieces apart or together until the field of view changes from two overlapping circles to one sharply defined circle. Focus each eyepiece independently, looking through the telescope with both

eyes open at an object several hundred yards away, covering the front of one telescope and turning the diopter scale until the object appears sharply defined, then repeating for the other eye. A diopter scale is provided for each eye, and if the observer remembers the values for his own eyes, the settings may be made directly on the scales. Turn reticle rotating ring until reticle appears erect.

(3) To orient instrument, select a datum point of known azimuth and set this value on azimuth scale (100-mil steps) and micrometer (1-mil steps). The throw-out lever may be used to disengage the

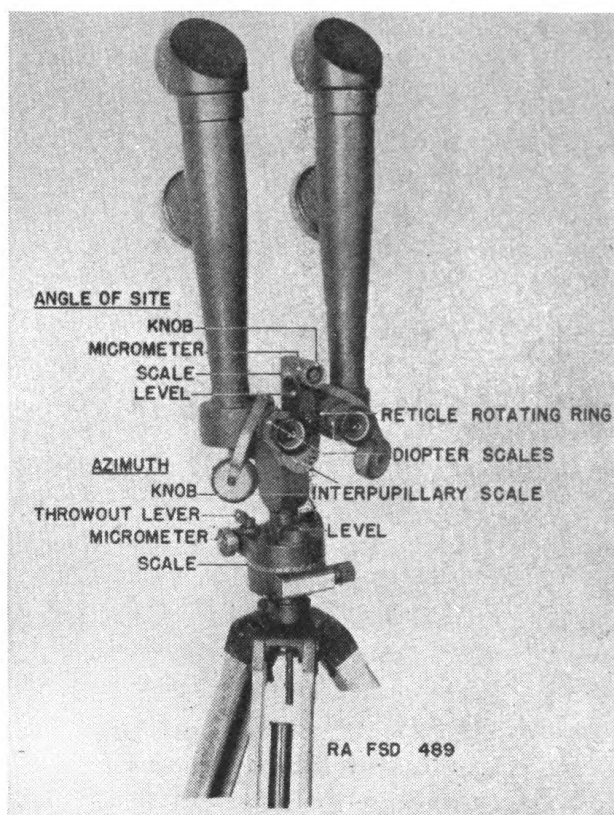


FIGURE 39.—Battery commander's telescope, M1915 (rear view).

worm drive for making large changes in azimuth rapidly. Turn telescope by means of orienting knob until datum point appears at center of reticle or right-hand telescope. The orienting clamping knob may be temporarily released for making large angular changes rapidly. Thereafter, use only azimuth knob or, for large changes, azimuth throw-out lever and correct azimuth of point observed will be indicated. For azimuths in the 3,200–6,400 mil region, additional numbers (0–3,200 mils) are provided, corresponding to the azimuth scales on panoramic telescopes and other instruments.

(4) To read angle of site, swing angle of site mechanism into a substantially vertical plane. Direct telescope on object and rotate elevating knob until object appears at center of reticle. By means of angle of site knob, center bubble of angle of site level in its vial. The angle of site is then read on the angle of site scale (100-mil steps) and micrometer (1-mil steps). An indication of 300 mils corresponds to a horizontal line of sight.

(5) To indicate angular indications on the reticle, the horizontal axis of the reticle is graduated at 5-mil intervals for 30 mils on each side of the center. The two short lines above the horizontal line are spaced 3 mils apart.

(6) To prepare instrument for traveling, remove sunshades and filters, if used, and place them in pockets of telescope carrying case. Cover objectives and eyepieces. With telescope shanks in a vertical position, press locking plunger and lift telescope from mount. Loosen telescope clamping knob and swing elevating mechanism against right- or left-hand telescope. The instrument will then fit snugly into the blocking of the case. Do not remove mount from tripod. Tripod leg-clamping levers should not protrude.

c. Tests and adjustments.—(1) The azimuth micrometer and azimuth scale should read zero simultaneously. The screw in the end of the micrometer may be temporarily loosened to permit slipping the micrometer to the desired position.

(2) The angle of site mechanism may be checked by observing a datum point of known angle of site. Small errors may be corrected by temporarily loosening the screw in the end of the knob and slipping the micrometer and knob to the correct position. Should the angle of site scale and micrometer then fail simultaneously to indicate 3 and 0, respectively, the instrument should be turned in for adjustment by authorized ordnance personnel.

(3) The ball and socket joint of the mount should have a snug friction fit when the associated clamping lever is released. Excessive tightness or lost motion may be adjusted by means of the plug in the center of the bottom of the mount. This plug is locked by the retaining ring concentric therewith which must be loosened for adjusting. Tighten retaining ring securely when adjustment is completed.

d. Care and preservation.—(1) Refer to paragraph 51 for general instructions pertaining to the care and preservation of instruments.

(2) Exposed moving parts should be oiled occasionally with a small quantity of neutral oil. Interior parts are not to be lubricated by the using arm. Keep excess lubricant that seeps from mechanisms wiped off to prevent accumulation of dust and grit.

51. Care and preservation.—a. General.—(1) These instructions supplement instructions pertaining to individual instruments included in preceding paragraphs.

(2) Fire control and sighting instruments are, in general, rugged and suited for the purposes for which they have been designed. They will not, however, stand rough handling or abuse, and inaccuracy or malfunctioning will result from such mistreatment.

(3) Disassembly and assembly by the using arm is permitted only to the extent authorized in the paragraphs dealing with the individual instruments. Unnecessary turning of screws or other parts not incident to the use of the instrument is expressly forbidden.

(4) Keep instruments as dry as possible. Do not put an instrument in its carrying case when wet.

(5) When not in use, keep instruments in carrying cases provided or in the condition indicated for traveling.

(6) Any instruments which indicate incorrectly or fail to function properly after the authorized tests and adjustments have been made are to be turned in for repair by ordnance personnel. Adjustments other than those expressly authorized in the paragraphs dealing with the individual instruments are not to be performed by the using arm.

(7) No painting of fire control equipment by the using arm is permitted.

(8) Many worm drives have throw-out mechanisms to permit rapid motion through large angles. When using these mechanisms, it is essential that the throw-out lever be fully depressed to prevent injury to the worm and gear teeth.

(9) When using a tripod with adjustable legs, be certain that the legs are clamped tightly to prevent possibility of collapse.

(10) When setting up tripods on sloping terrain, place two legs on the downhill side to provide maximum stability.

b. Leather articles.—Care and preservation of leather articles is covered in AR 30-3040.

c. Optical parts.—(1) To obtain satisfactory vision, it is necessary that the exposed surfaces of the lenses and other parts be kept clean and dry. Corrosion and etching of the surface of the glass, which greatly interfere with the good optical qualities of the instrument, can be prevented or greatly retarded by keeping the glass clean and dry.

(2) Under no condition will polishing liquids, pastes, or abrasives be used for polishing lenses and windows.

(3) For wiping optical parts use only lens paper specially intended for cleaning optical glass. Use of cleaning cloths in the field is not permitted. To remove dust, brush the glass lightly with a clean

camel's-hair brush and rap the brush against a hard body in order to knock out the small particles of dust that cling to the hairs. Repeat this operation until all dust is removed. With some instruments an additional brush with coarse bristles is provided for cleaning mechanical parts. It is essential that each brush be used only for the purpose intended.

(4) Exercise particular care to keep optical parts free from oil and grease. Do not wipe the lenses or windows with the fingers. To remove oil or grease from optical surfaces, apply ethyl alcohol with a clean camel's-hair brush and rub gently with clean lens paper. If alcohol is not available, breathe heavily on the glass and wipe off with clean lens paper. Repeat this operation several times until clean.

(5) Moisture due to condensation may collect on the optical parts of the instrument when the temperature of the parts is lower than that of the surrounding air. This moisture, if not excessive, can be removed by placing the instrument in a warm place. Heat from strongly concentrated sources should not be applied directly, as it may cause unequal expansion of parts, thereby resulting in breakage of optical parts or inaccuracies in observation.

CHAPTER 4

AMMUNITION

	Paragraph
General	52
Nomenclature	53
Classification	54
Firing tables	55
Identification	56
Mark or model	57
Ammunition lot number	58
Ammunition data card	59
Painting and marking	60
Weight zone markings	61
Care, handling, and preservation	62
Authorized rounds	63
Fuzes	64
Fuze, P. D., Mk. III, superquick, without interrupter	65
Fuze, P. D., Mk. III, superquick, with interrupter	66
Fuze, P. D., Mk. IIIA, superquick, without interrupter	67
Fuze, P. D., Mk. IIIA, superquick, with interrupter	68
Fuze, P. D., Mk. IV, short delay	69
Fuze, P. D., Mk. IV Star, short delay	70
Fuze, P. D., M35	71
Fuze, P. D., M46	72
Fuze, P. D., M47	73
Fuze, P. D., M48	74
Fuze, P. D., M54	75
Fuze, P. D., T18	76
Fuze, combination, 21-second, M1907M	77
Packing	78
Subcaliber ammunition	79

52. General.—*a.* Ammunition for the 75-mm gun, M1917, and modifications thereof, is issued in the form of fixed rounds, either as unfuzed or fuzed complete rounds. A complete round includes all of the ammunition components used in a cannon to fire one round.

b. In fixed ammunition the cartridge case, which contains the propelling charge and primer, is crimped rigidly to the projectile. Until recently, designs of fixed rounds provided for issue of the round unfuzed, the fuze to be assembled just prior to firing. In current designs the round is issued as a fixed complete round, the fuze being assembled to the round as issued.

53. Nomenclature.—Standard nomenclature is used herein in all references to specific items of issue.

54. Classification.—Dependent upon the kind of filler, projectiles may be classified according to type as explosive, chemical, or inert. Explosive projectiles comprise high explosive, practice, and shrapnel. High explosive projectiles contain a high explosive bursting charge, whereas shrapnel and practice projectiles contain a relatively small quantity of low explosive filler. The modern shrapnel is a projectile designed to carry a large number of spherical shot affixed in a matrix, which, at a distance from the gun, are discharged over an extended area. The low explosive filler for practice projectiles is intended solely as a spotting charge and for some purposes may be omitted. Chemical projectiles comprise those containing a chemical filler, that is, an agent which produces either a toxic or an irritating physiological effect, a screening smoke, incendiary action, or a combination of these. Inert projectiles contain no explosive.

55. Firing tables.—For applicable firing tables, trajectory charts, and trajectory diagrams see Appendix.

56. Identification.—Ammunition, including components, is completely identified by means of the painting, marking (includes ammunition lot number), and accompanying data card. Other essential information, such as weight zone and muzzle velocity, is included in the marking. (See figs. 40-43, incl., and pars. 57-79, incl.)

57. Mark or model.—To identify a particular design, a model designation is assigned. This model designation becomes an essential part of the nomenclature and is included in the marking on the item. Prior to July 1, 1925, it was the practice to assign mark numbers, the word "Mark" being abbreviated "Mk.," which was followed by a roman numeral; for example, shell, H. E., Mk. I. The first modification of a model was indicated by the addition of MI, the second by MII, etc. Thus, Mk. IMII indicated the second modification. The present system of model designation consists of the letter M followed by an arabic numeral. Modifications are indicated by adding the letter A and appropriate arabic numeral. Thus, M9A1 indicates the first modification of an item for which the original model designation was M9.

58. Ammunition lot number.—When ammunition is manufactured, an ammunition lot number, which becomes an essential part of the marking, is assigned in accordance with pertinent specifications. This lot number is stamped or marked on every loaded complete round, on all packing containers, and on the accompanying ammunition data card. It is required for all purposes of record, including reports on condition, functioning, and accidents in which ammunition is involved.

To provide for the most uniform functioning, all of the rounds in any one lot of fixed ammunition consist of—

Projectiles of one lot number (one type and one weight zone).

Fuzes of one lot number.

Primers of one lot number.

Propellant powder of one lot number.

Therefore, to obtain the greatest accuracy in any firing, successive rounds should be from the same ammunition lot whenever practicable.

59. Ammunition data card.—A 5- by 8-inch card, known as an ammunition data card, is packed in each packing box with the ammunition or, in the case of bundle packing, with the round in each fiber container. When required, assembling instructions are printed on the reverse side of the card.

60. Painting and marking.—*a. Painting.*—All projectiles are painted to prevent rust, and by means of the color to provide a ready means for identification as to type. The color scheme is as follows:

High explosive..... Yellow.

Chemical..... Gray (one green band on a chemical projectile indicates nonpersistent gas. Two green bands indicate persistent gas. One yellow band indicates a smoke projectile. The marking on chemical projectiles is in the same color as the band).

Shrapnel..... Red.

Practice..... Blue (may contain only a sand filler with an inert fuze or a live fuze with a spotting charge of black powder).

Inert (dummy or drill)--- Black.

b. Marking.—(1) With the exception of shrapnel the following information is stenciled or stamped on the projectile in all fixed rounds. On shrapnel, the only marking required on the projectile is that of caliber, type of cannon in which fired, and lot number.

Caliber and type of cannon in which fired.

Kind of filler, for example, TNT, CN gas, etc.

Mark or model of projectile.

Weight zone marking.

Because the lot number of the loaded projectile is ordinarily not required after the complete round has been assembled, it is stenciled below the rotating band, in which position it is covered by the neck of the cartridge case.

(2) The following information is stenciled or stamped in black on the body of the cartridge case:

“FLASHLESS” when the propelling charge is of flashless (FNH) powder.

“REDUCED CHARGE” between two black bands indicates reduced charge; “SUPER” indicates supercharge; absence of such markings indicates normal charge.

Symbol of powder, initials of powder manufacturer, and lot number.

Caliber and type of cannon in which fired.

Muzzle velocity in feet per second.

(3) The following information is stenciled in black or stamped on the base of the cartridge case:

Ammunition lot number.

Caliber, type, and model of cannon in which fired.

Cartridge case lot number.

“FLASHLESS” when propelling charge is flashless (FNH) powder.

Model of projectile. Absence of such model indicates shrapnel. If chemical, the type of filler is shown.

One diametral stripe indicates normal charge; two diametral stripes at right angles indicate reduced charge; “SUPER-CHARGE” indicates a supercharge.

(4) Action has recently been taken to reduce the amount of marking on fixed ammunition by the elimination of “FLASHLESS” and all data pertaining to the powder and muzzle velocity. “REDUCED,” “NORMAL,” and “SUPER” will be used to indicate reduced charge, normal charge, and supercharge, and will appear on both the base and the body of the cartridge case. The black stripes and bands now used on the base and body of the cartridge case will remain with no change in significance. In addition to these, one black band will be added to the body of the cartridge case to indicate normal charge.

61. Weight zone markings.—Because it is not practicable to manufacture high explosive or chemical projectiles within the narrow weight limits required for the desired accuracy of fire, projectiles are grouped into weight zones in order that the appropriate ballistic corrections indicated by firing tables may be applied. The weight zone of the projectile is marked thereon by means of black crosses, 1, 2, 3, 4, or 5, depending upon the weight of the projectile. A weight zone lighter than one cross is indicated by L. Two crosses indicate normal weight.

62. Care, handling, and preservation.—Complete rounds and ammunition components are packed to withstand conditions

ordinarily encountered in the field. Each complete round is packed in an individual moisture resistant metal or fiber container and then in a wooden packing box or bundle. Fuzes which are issued separately are packed in sealed metal lined boxes. Nevertheless, since explosives are adversely affected by moisture and high temperature, due consideration should be given to the following precautions:

a. (1) Do not break moisture resistant seal until ammunition is to be used.

(2) Protect the ammunition, particularly fuzes, from high temperatures, including the direct rays of the sun. More uniform firing is obtained if the rounds are at the same temperature.

b. Do not attempt to disassemble any fuze.

c. Do not remove the adapter closing plug from unfuzed rounds until the fuze is to be assembled thereto. The adapter closing plug is provided to keep the fuze opening free of foreign matter in order that the fuze may be readily and properly screwed in.

d. Handle fuzes with care. The explosive elements are particularly sensitive to undue shock and high temperature.

e. The complete round should be free of foreign matter—sand, mud, grease, etc.—before loading into the gun.

f. Do not remove protection or safety devices from fuzes until just before use.

g. Components of rounds prepared for firing but not fired will be returned to their original packings and appropriately marked. Such components will be used first in subsequent firings in order that stocks of opened packings may be kept at a minimum.

63. Authorized rounds.—The 75-mm guns, M1917 and M1917A1, being chambered alike, fire the same ammunition. The ammunition authorized for use therein is listed below. It will be noted that the designation completely identifies the ammunition as to type and model of the projectile and the fuze, type, and kind of propelling charge, and caliber of gun in which the round is fired. Unless otherwise indicated, the propelling charge is understood to be a normal charge of pyro powder. Super or reduced charges of non-hygroscopic (NH) or flashless (FNH) powder are so indicated and correspondingly marked on the cartridge case. To the nomenclature of ammunition which is issued unfuzed, a suffixed statement such as “adapted for PDF Mk. III, Mk. IV, M35, M46, or M47”, indicates the fuzes authorized for use therewith. For ammunition which is issued fuzed, shrapnel excepted, a statement in the nomenclature such as “w/PDF M48” indicates the type and model of fuze assembled thereto.

AMMUNITION FOR GUN, 75-MM, M1917 AND M1917A1

Nomenclature	Prescribed fuzes		Substitute fuzes	
	Model	Action	Model	Action
<i>Service ammunition</i>				
Shell, fixed, gas, persistent, HS, Mk. II, unfuzed, 75-mm gun (adapted for PDF Mk. III, Mk. IV, M35, M46, or M47).	M46-----	SQ-----	Mk. III or M35.	SQ.
	M47-----	Del-----	Mk. IV-----	Del.
Shell, fixed, gas, persistent, HS, T10, w/PDF T18, 75-mm gun.	T18-----	SQ-----		
Shell, fixed, gas, persistent, NC, Mk. II, unfuzed, 75-mm gun (adapted for PDF Mk. III, Mk. IV, M35, M46, or M47).	M46-----	SQ-----	Mk. III or M35.	SQ.
	M47-----	Del-----	Mk. IV-----	Del.
Shell, fixed, H. E., M48, w/PDF M48, 75-mm gun.	M48-----	SQ-Del-----		
Shell, fixed, H. E., M48, w/PDF M54, 75-mm gun.	M54-----	SQ-Time-----		
Shell, fixed, H. E., M48, reduced charge, w/PDF M48, 75-mm gun.	M48-----	SQ-Del-----		
Shell, fixed, H. E., M48, reduced charge, w/PDF M54, 75-mm gun.	M54-----	SQ-Time-----		
Shell, fixed, H. E., M48, supercharge, w/PDF M48, 75-mm gun.	M48-----	SQ-Del-----		
Shell, fixed, H. E., M48, supercharge, w/PDF M54, 75-mm gun.	M54-----	SQ-Time-----		
Shell, fixed, H. E., Mk. I, flashless, reduced charge, unfuzed, 75-mm gun (adapted for PDF M46, Mk. IV, or M47).	M46-----	SQ-----		
	M47-----	Del-----	Mk. IV-----	Del.
Shell, fixed, H. E., Mk. I, flashless, unfuzed, 75-mm gun (adapted for PDF Mk. III, Mk. IV, M35, M46, or M47).	M46-----	SQ-----	Mk. III or M35.	SQ.
	M47-----	Del-----	Mk. IV-----	Del.
Shell, fixed, H. E., Mk. I, reduced charge, unfuzed, 75-mm gun (adapted for PDF Mk. IV, M46, or M47).	M46-----	SQ-----		
	M47-----	Del-----	Mk. IV-----	Del.
Shell, fixed, H. E., Mk. I, unfuzed, 75-mm gun (adapted for PDF Mk. III, Mk. IV, M35, M46, or M47).	M46-----	SQ-----	Mk. III or M35.	SQ.
	M47-----	Del-----	Mk. IV-----	Del.
Shell, fixed, smoke, FM, Mk. II, unfuzed, 75-mm gun (adapted for PDF Mk. III, Mk. IV, M35, M46, or M47).	M46-----	SQ-----	Mk. III or M35.	SQ.
	-----	-----	Mk. IV-----	Del. ¹

¹ Fired for ricochet only.

AMMUNITION FOR GUN, 75-MM, M1917 AND 1917A1—Continued

Nomenclature	Prescribed fuzes		Substitute fuzes	
	Model	Action	Model	Action
<i>Service ammunition—Con.</i>				
Shell, fixed, smoke, FS, T10, w/PDF T18, 75-mm gun.	T18-----	SQ-----	-----	SQ.
Shell, fixed, smoke, phosphorus, WP, T10, w/PDF T18, 75-mm gun.	T18-----	SQ-----	-----	
Shell, fixed, smoke, phosphorus, WP, Mk. II, unfuzed, 75-mm gun (adapted for PDF Mk. III, Mk. IV, M35, M46, or M47).	M46-----	SQ-----	Mk. III or M35.	
Shrapnel, fixed, Mk. I, 75-mm gun.	M1907M---	21-sec---	-----	
Shrapnel, fixed, Mk. I, flashless, 75-mm gun.	M1907M---	21-sec---	-----	
<i>Target practice ammunition</i>				
Shell, fixed, practice, sand loaded, Mk. I, 75-mm gun (with inert PDF Mk. IV).	Mk. IV, inert.	-----	-----	
<i>Blank ammunition</i>				
Ammunition, blank (1-lb. charge), 75-mm guns, M1897-16-17, and 75-mm pack howitzer, M1 and M1A1.	None-----	-----	-----	
Ammunition, blank (double pellet charge), 75-mm guns, M1897-16-17, and 75-mm pack howitzer, M1 and M1A1.	None-----	-----	-----	
<i>Drill ammunition</i>				
Cartridge, drill, M7, 75-mm guns, M1897-16-17.	M1907M inert.	-----	-----	
	M46, ² inert.	-----	Mk. III, ² inert.	
	M47, ² inert.	-----	Mk. IV, ² inert.	

² Requires adapter, 72-3-66M.
SQ, superquick; Del, delay; PDF, point detonating fuze.

64. Fuzes.—a. General.—A fuze is a mechanical device used with a projectile to explode it at the time and under the circumstances desired.

NOTE.—No attempt will be made to disassemble any fuze. The only authorized assembling or disassembling operation is that of screwing the fuze into the projectile or out of it if the projectile is not fired. (See par. 62g.)

b. Types.—(1) Fuzes may be classified in two principal types: those which function by time action a certain number of seconds after firing, and those which function as the result of impact of the fuze or the projectile with a resistant object.

(2) Further subdivision of the impact types is dependent upon quickness of action, the classifications being superquick, nondelay, short delay, and long delay.

(3) Dependent upon the manner of arming, certain fuzes are considered to be boresafe as distinct from those which are not boresafe. A boresafe fuze is one in which the explosive train is so interrupted while the projectile is in the bore of the gun that premature functioning of the projectile cannot occur therein, even though the more sensitive explosive elements in the fuze should function prematurely.

c. Boresafe and nonboresafe fuzes.—Those classified as boresafe and nonboresafe are as follows:

Fuze, P. D.

Boresafe	Nonboresafe ¹
M48 ¹ -----	Mk. III, SQ, without interrupter.
M54 ¹ -----	Mk. III, SQ, with interrupter.
T18 ¹ -----	Mk. IIIA, SQ, without interrupter.
	Mk. IIIA, SQ, with interrupter.
	Mk. IV, short delay.
	M35.
	M46.
	M47.

¹ Assembled to fixed round. Not issued separately for use in the field.

² Fuze, combination, 21-second, M1907M, also classified as nonboresafe.

65. Fuze, P. D., Mk. III, superquick, without interrupter.—Except that this fuze has no interrupter, it is the same as the fuze, P. D., Mk. III, superquick, with interrupter. With this exception the description in paragraph 66 applies.

66. Fuze, P. D., Mk. III, superquick, with interrupter.—*a. Description.*—This fuze (fig. 44) is of the direct action type intended to detonate with the least possible penetration of the projectile. Subject to the provisions of OFSB 3-3, authorized use is shown in paragraph 63. It should not be used in ammunition with a reduced charge since its use at this lower velocity causes the projectile to be unstable in flight.

b. Preparation for firing.—To assemble fuze to round proceed as follows:

- (1) Remove adapter closing plug from projectile.

(2) Visually inspect fuze cavity and threads. They should be free of any foreign matter which would interfere with the proper assembly of the fuze.

(3) Screw fuze into adapter by hand. It is essential that the felt washer provided with the fuze be under the detonator socket flange when the fuze is screwed into the adapter. Tighten with fuze wrench. Use only fuzes on which original waterproof seal of lead foil cap is unbroken.

(4) Before loading the round into gun, remove waterproof cap by pulling on exposed loose end of tape. Examine spiral (brass ribbon) where it is coiled around fuze and safety pin visually to see that they are in good condition. When either is damaged or missing, the fuze will be removed and replaced by a serviceable fuze. The complete round is then ready for firing. The unserviceable fuze will be disposed of as prescribed in TM 9-1900 (now published as TR 1370-A).

67. Fuze, P. D., Mk. IIIA, superquick, without interrupter.—This fuze may be distinguished from the fuze, P. D., Mk. III, superquick, without interrupter, by the A in the model designation stamped on the body of the fuze. Otherwise, the only difference is in the arrangement of the upper detonator.

68. Fuze, P. D., Mk. IIIA, superquick, with interrupter.—This fuze may be distinguished from the fuze, P. D., Mk. III, superquick, with interrupter, by the A in the model designation stamped on the body of the fuze. Otherwise, the only difference is in the arrangement of the upper detonator.

69. Fuze, P. D., Mk. IV, short delay.—*a. Description.*—This fuze (fig. 48) is a short delay inertia plunger type. There are on hand fuzes of both short delay and long delay. Both have black heads, but the detonator socket of the short delay type is unpainted, whereas that of the long delay type is painted violet. Only the short delay is authorized for use with 75-mm ammunition. Another type of fuze with which the Mk. IV should not be confused is the Mk. IV Star (see par. 70). Except for the stamping and marking thereon, these fuzes appear to be identical.

b. Preparation for firing.—To assemble fuze to unfuzed fixed round proceed as follows:

(1) Remove adapter closing plug from projectile.

(2) Visually inspect fuze cavity and threads. They should be free of foreign matter which would interfere with the proper assembly of the fuze.

(3) Screw fuze into adapter by hand. It is essential that the felt washer provided with the fuze be under the detonator socket flange

when the fuze is screwed into the adapter. Tighten with fuze wrench. The complete round is then ready for firing.

70. Fuze, P. D., Mk. IV star, short delay.—*a. Description.*—This fuze differs functionally from the fuze, P. D., Mk. IV (unstarred) in that it has a stronger retard spring. It is identified by a star (*) stamped after Mk. IV on the head, and the conical portion of the head which is painted green. Otherwise these two fuzes are identical. This fuze is used with 75-mm. ammunition having normal charges whereas the fuze, P. D., Mk. IV is used with 75-mm. ammunition having reduced charges.

b. Preparation for firing.—This fuze is assembled to the round in the same manner as the fuze, P. D., Mk. IV. (See par. 69.)

71. Fuze, P. D., M35.—*a. Description.*—This fuze (fig. 45) is a modified Mk. III superquick type. Compared with the Mk. III type it is somewhat shorter, and a sleeve has been added to hold the spiral (brass ribbon) in position. The sleeve is held in place by a pin which is sheared by set-back in firing, thereby freeing the spiral. For safety in transportation a spring clip, designated "sleeve support," is used. This fuze, like the Mk. III type, is unsuitable for use in reduced charge rounds due to lack of stability of the projectile.

b. Preparation for firing.—To assemble fuze to round proceed as follows:

- (1) Remove adapter closing plug from projectile.
- (2) Visually inspect fuze cavity and threads. They should be free of foreign matter which would interfere with the proper assembly of the fuze.
- (3) Screw fuze into adapter by hand. It is essential that the felt washer provided with the fuze be under the detonator socket flange when the fuze is screwed into the adapter. Tighten with fuze wrench.
- (4) By means of a pull on the ring, remove sleeve support. The round is then ready for firing.

72. Fuze, P. D., M46.—*a. General.*—This fuze, a superquick type (fig. 46), is a further modification of the Mk. III type. The firing mechanism has been modified to eliminate the spiral and split rings. A lighter firing pin is supported on a brass cup which is sufficiently strong to resist the set-back produced by acceleration in the gun, but which is crushed when the firing pin is driven into the primer on impact. This fuze is suitable for use with either normal or reduced charge rounds. Although the external form of this fuze is the same as that of the fuze, P. D., M47 (par. 73), it is readily identified by "P. D. F. M46" stamped on the body and its head which is painted white. The fuze P. D., M47, is stamped "P. D. F. M47" and has a black head.

b. Preparation for firing.—To fuze round proceed as follows:

(1) Remove adapter closing plug from projectile.

(2) Visually inspect fuze cavity and threads. They should be free of foreign matter which would interfere with the proper assembly of the fuze.

(3) Screw fuze into adapter by hand. It is essential that the felt washer provided with the fuze be under the detonator socket flange when the fuze is screwed into the adapter. Tighten with fuze wrench. The complete round is then ready for firing.

73. Fuze, P. D., M47.—*a. Description.*—This fuze, a delay type (fig. 47), is identical ballistically with the fuze, P. D., M46. It can be distinguished from the latter fuze, however, by the marking and the black head—the M46 fuze has a white head. (See also par. 72.) To provide for delay action a delay pellet, 0.05 second, is incorporated in the explosive train between the upper detonator and the detonator proper.

b. Preparation for firing.—To fuze round proceed as follows:

(1) Remove adapter closing plug from projectile.

(2) Visually inspect fuze cavity and threads. They should be free of foreign matter which would interfere with the proper assembly of the fuze.

(3) Screw fuze into adapter by hand. It is essential that the felt washer provided with the fuze be under the detonator socket flange when the fuze is screwed into the adapter. Tighten with fuze wrench. The round is then ready for firing.

74. Fuze, P. D., M48.—*a. Description.*—This fuze (fig. 49) is a combination superquick and short delay type. It will always be issued assembled to shell. The fuze contains two actions, superquick and delay. On the side of the fuze near the base are a slotted setting sleeve and two registration lines, one parallel to the axis of the fuze, the other at right angles thereto. The line parallel to the axis is marked "S. Q.," the other "DELAY." To set the fuze, the setting sleeve is turned so that the slot is alined with S. Q. or DELAY, whichever is required. The setting may be made or changed at will with a screw driver or other similar instrument any time before firing, even in the dark, by noting the position of the slot—parallel to the fuze axis for S. Q., at right angles thereto for DELAY. It should be noted that in this fuze even though set superquick, the delay action will operate should the superquick action fail to function.

b. Preparation for firing.—Prior to firing, it is only necessary to set the fuze and this only when delay action is required; when shipped the fuze is set superquick.

75. Fuze, P. D., M54.—*a. Description.*—This standard fuze (fig. 50) is a combination superquick time type. These fuzes will always be issued assembled to shell. A safety pin extends through the fuze to secure the time plunger during shipment. The fuze contains two actions, superquick and time. The superquick action is always operative and will function on impact, unless prior functioning has been caused by the time action. Therefore, to set the fuze for superquick action, it is required that the time action be set either at safe (S) or for a time longer than expected time of flight. The time train ring, graduated for 25 seconds, is similar to that of other powder time train fuzes. The fuze is set for time by means of a fuze setter. The minimum time of burning is 0.4 second.

b. Preparation for firing.—Prior to firing, the safety pin must be withdrawn from the fuze. If superquick action is required, the graduated time ring is set safe (S) or for a time greater than the expected time of flight.

NOTE.—The fuze as shipped is set safe. If time action is required, the graduated time train ring is set for the required time of burning by means of a fuze setter.

76. Fuze, P. D., T18.—*a. Description.*—This fuze (fig. 51) is a superquick time type. These fuzes will always be issued assembled to shell. The fuze provides only for superquick action.

b. Preparation for firing.—No special preparation prior to firing is required.

77. Fuze, combination, 21-second, M1907M.—*a. Description.*—This fuze (fig. 52) is a combination percussion time type designed for use with shrapnel. These fuzes will always be issued assembled to shell. The fuze contains two actions, percussion and time. The percussion action is always operative and will function on impact unless prior functioning has been caused by the time action. When percussion action is required, it is only necessary to set the graduated time train ring at safe (S) or for a time longer than the expected time of flight. The time train ring is similar to that of other powder time train fuzes and is graduated for 21.2 seconds. The fuze is set for time by means of a fuze setter. In the particular case of 0 setting, canister effect is obtained, that is, the fuze functions just beyond the muzzle of the cannon with the result that the shrapnel balls are projected from the shrapnel case somewhat similar to shot from a shotgun. Because the powder time train is adversely affected by moisture, every effort will be made to keep the fuze dry.

b. Preparation for firing.—The waterproof fuze cover must first be removed. If percussion action is required, the graduated time is set safe (S) or for a time greater than the expected time of flight.

NOTE.—The fuze as shipped is set safe. If time action is required, the graduated time train ring is set for the required time of burning by means of a fuze setter.

78. Packing.—*a. General.*—Fixed rounds of 75-mm gun ammunition are packed in individual metal or fiber containers, and these in wooden boxes containing four rounds or in special bundle packings of three rounds. While the weights of the individual rounds vary somewhat, depending upon type and model, the following data are considered representative for estimating weight and volume requirements:

	Weight (pound)	Volume (cubic foot)
Complete round with packing material-----	18	
3 rounds in bundle packing-----	60	1.0
4 rounds in wooden packing box -----	100	1.7

The over-all dimensions of the packings are—

3 round bundle-----inches--	27 $\frac{1}{8}$ by 8.10 by 7.57
4 round box-----do-----	30 $\frac{3}{4}$ by 9 $\frac{1}{4}$ by 9 $\frac{1}{4}$

Bundles for oversea shipment are crated.

b. Fuzes.—Similar representative data for fuzes are—

Approximate dimensions of wooden box--inches--	18 by 9 by 8
Approximate volume-----cu. ft--	0.80
Approximate weight of box and 50 fuzes ¹ ---lbs--	53

¹ Fuze, P. D. Mk. IV and Mk. IV Star, short delay, being smaller is packed 100 per box of approximately the same size and weight.

79. Subcaliber ammunition.—Shell, fixed, L. E., Mk. I, 37-mm gun, M1916, is authorized for use in the gun, subcaliber, 37-mm, M1916A1, when the subcaliber gun is used with the gun, 75-mm, M1917 or M1917A1. The complete round is shown in figure 53 and may be identified by the marking indicated thereon; otherwise the information contained in paragraphs 53 to 60, inclusive, and 62 applies.

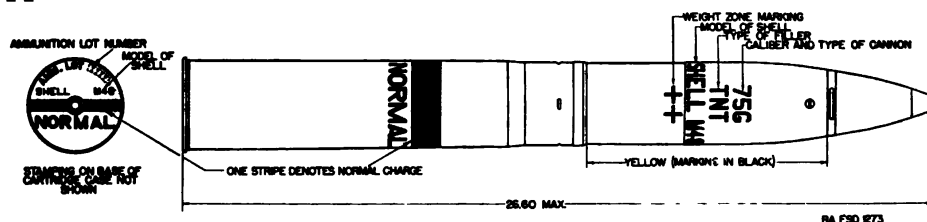


FIGURE 40.—Shell, fixed, H. E., M48, w/PDF M48, 75-mm gun, as fired.

FIGURE 41.—Shell, fixed, H. E., Mk. I, w/PDF M46, 75-mm gun, as fired.

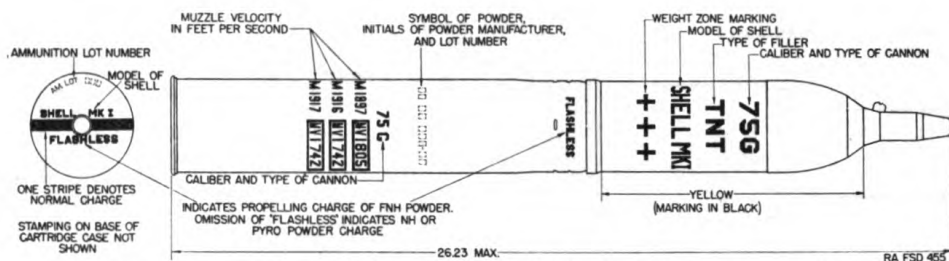


FIGURE 42.—Shell, fixed, smoke, phosphorus, WP, Mk. II, 75-mm gun (upper : as received (unfuzed) ; lower : as fired (w/PDF M46)).

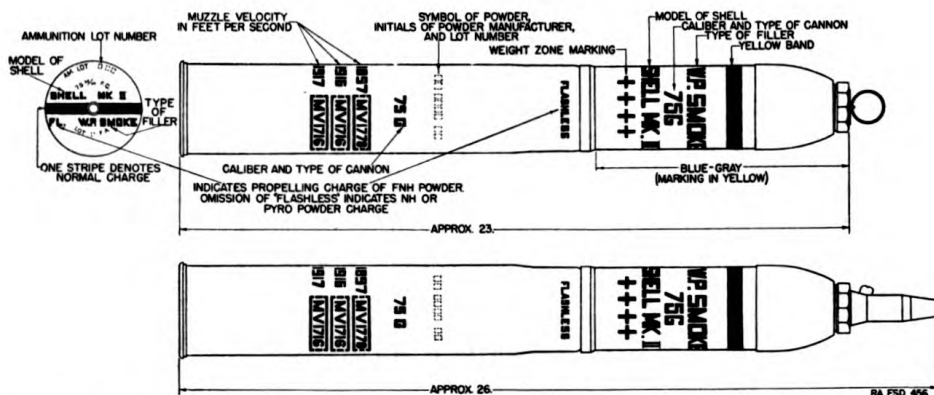


FIGURE 43.—Shrapnel, fixed, Mk. I, flashless, 75-mm gun (upper: as received; lower: as fired).

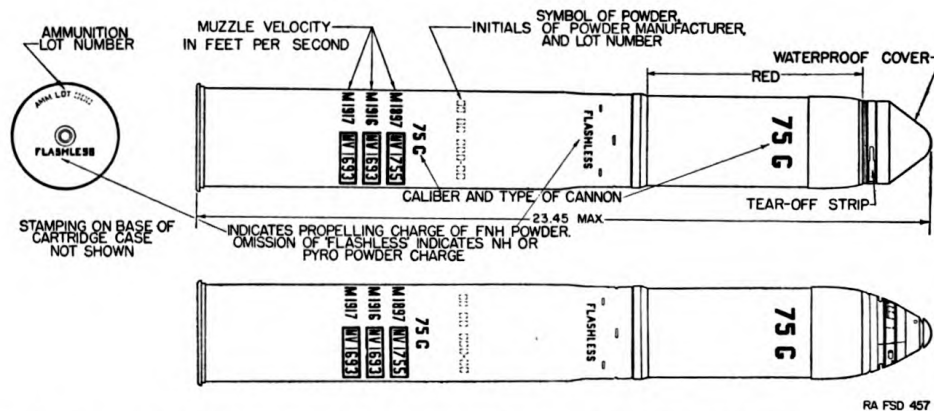


FIGURE 44.—Fuze, P. D., Mk. III, superquick, with interrupter.

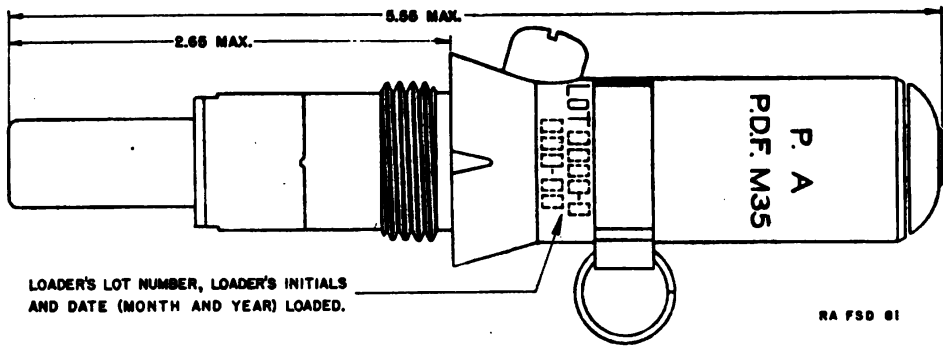


FIGURE 45.—Fuze, P. D., M35.

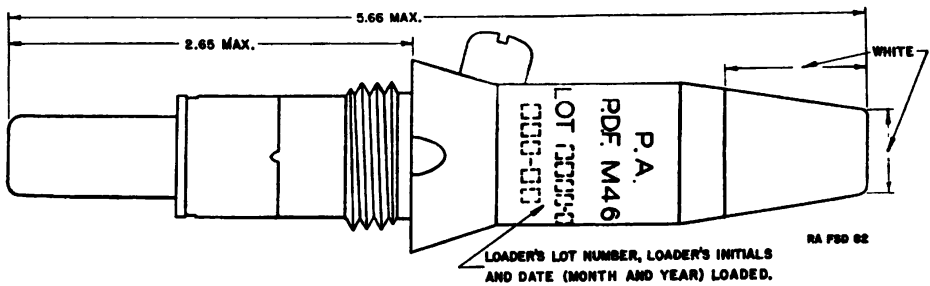


FIGURE 46.—Fuze, P. D., M46.

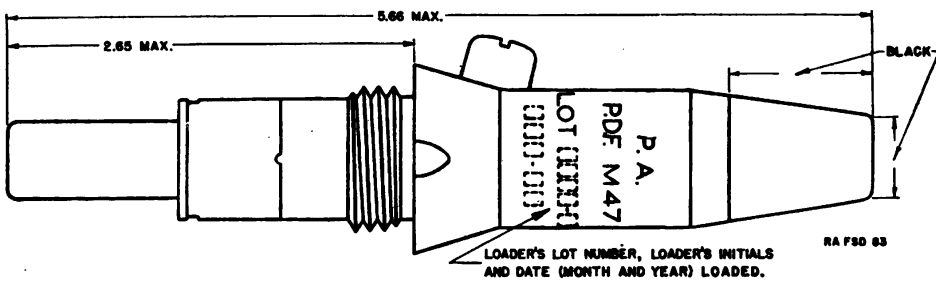


FIGURE 47.—Fuze, P. D., M47.

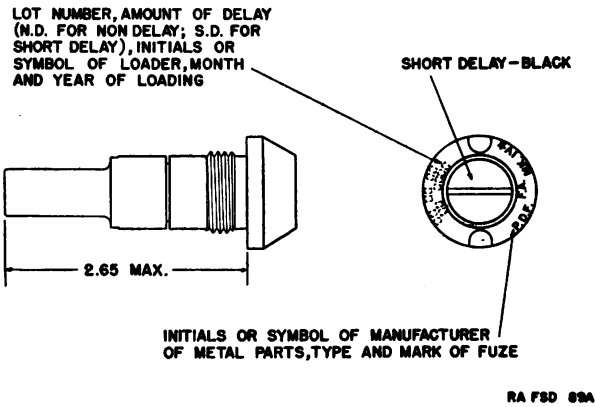


FIGURE 48.—Fuze, P. D., Mk. IV, short delay.

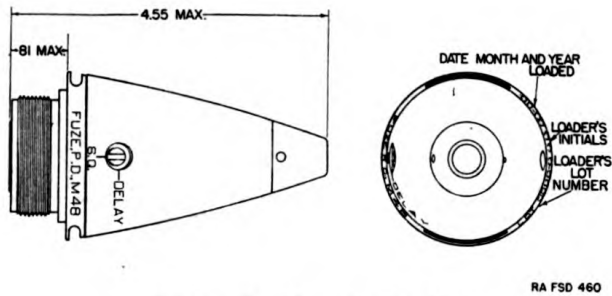


FIGURE 49.—Fuze, P. D., M48.

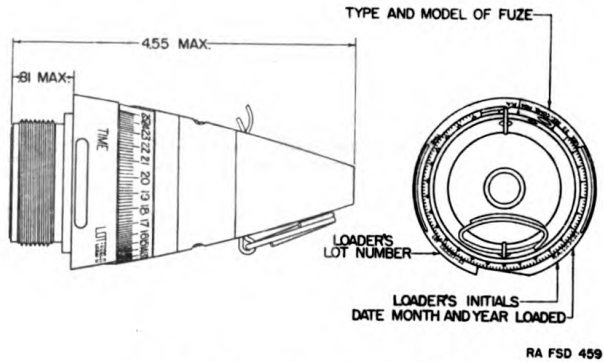


FIGURE 50.—Fuze, P. D., M54.

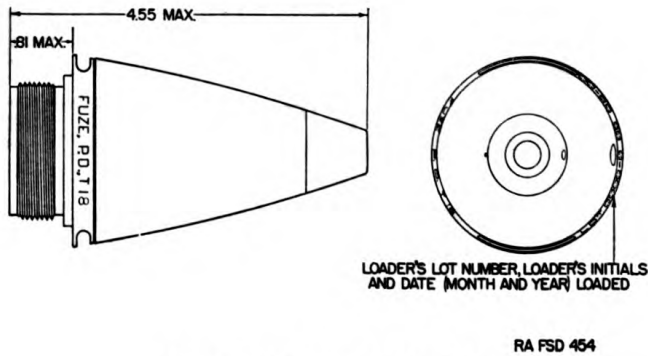


FIGURE 51.—Fuze, P. D., T18.

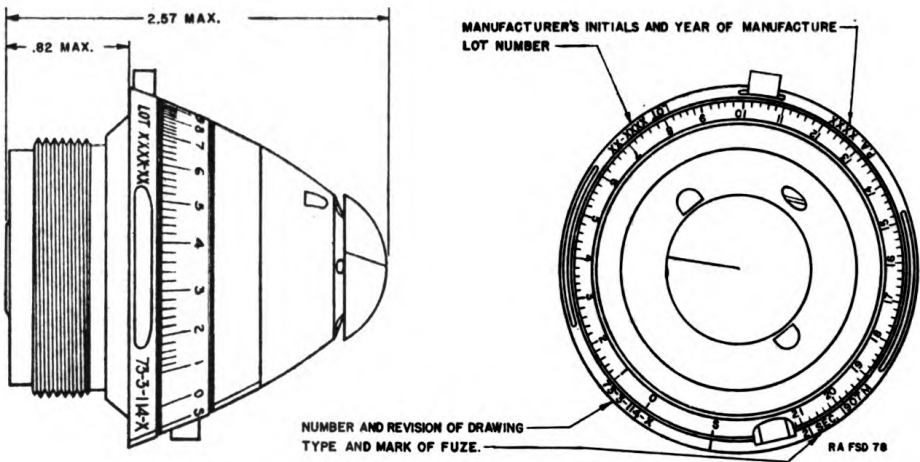


FIGURE 52.—Fuze, combination, 21-second, M1907M.



FIGURE 53.—Shell, fixed, L. E., Mk. I, 37-mm gun, M1916.

CHAPTER 5

SPARE PARTS AND ACCESSORIES

	Paragraph
Spare parts.....	80
Accessories	81

80. Spare parts.—*a.* Parts become unserviceable through breakage or through wear resulting from continuous usage. For this reason certain parts are provided for replacement purposes. These parts are divided into two groups, spare parts and basic spare parts. The using arm has no concern with basic spare parts except possibly in an emergency to draw a part from the ordnance maintenance company.

b. Spare parts are extra parts provided with the matériel for replacement of those most likely to fail, and are for use by the using arm in making minor repairs. Sets of spare parts should be maintained as complete as possible at all times and should be kept clean and oiled to prevent rust. The allowances of spare parts are prescribed in pertinent standard nomenclature lists.

81. Accessories.—*a. General.*—Accessories include the tools and equipment required for such disassembling and assembling as the using arm is authorized to do, and for the cleaning and preservation of the matériel. They also include chests, covers, tool rolls, etc., necessary for storage and protection when the matériel is not in use or when traveling. Additional accessories and supplies of a general nature are provided for battery use. Accessories should not be used for purposes other than as prescribed. There are a number of accessories the names or general characteristics of which indicate their uses or application. Therefore, detailed descriptions or methods of use are not outlined herein. However, accessories embodying special features or having special uses are described in *b* to *j*, inclusive, below.

b. Book, artillery gun.—The gun book (O. O. Form 5825) is used for the purpose of keeping an accurate record of the matériel. It must always remain with the matériel regardless of where it may be sent. The book is divided as follows: Record of assignments, company commander's daily gun record, inspector's record of examination, as well as a reference to forms to be filled out in case of premature explosions. This book should be in the possession of the organization at all times,

and it is the responsibility of the organization commander as to the completeness of records and the book's whereabouts. It must also contain date of issuance of the matériel, to and by whom issued, and place where issued. If a new gun is installed on the carriage, all data in the old book with reference to sights, carriage, etc., must be copied into the new gun book before the old book is relinquished.

NOTE.—Data pertaining to record of assignments must be removed and destroyed prior to entering combat.

c. Brush, slush, M1.—The slush brush is composed of a cylindrical piece of wood to which is attached a carpet-covered pad. This in turn is attached to a staff by means of a coupling. It is used to coat the rifling of the gun with lubricating oil.

d. Compressor, spring, No. 5.—The spring compressor consists of a 16-foot length of wire rope with an eye at one end and a threaded stud for attaching it to the counterrecoil buffer at the other end. It is used with a chain block when disassembling or assembling the counter-recoil springs.

e. Lanyards, firing.—There are two types of firing lanyards, the difference being in the lengths of cord, one 6 feet long and the other 50 feet. The longer lanyard is for peacetime firing only. Each lanyard is equipped with a handle or toggle at one end and a hook at the other for attaching the lanyard to the firing mechanism of the gun.

f. Sponge and staff.—The sponge and staff are used for swabbing and cleaning the bore of the gun. The sponge is a piece of carpet mounted on a leather covered bronze tube which slips over a bronze head. The head is bored for use as a rammer. It fits over the fuze of the shell for its removal when it is not desired to fire after the shell has been inserted in the gun. The two-sectioned staff is assembled and attached to the head by a coupling.

g. Tool, packing gland (collar).—This tool consists of a tapered bronze sleeve with a square notch cut at one end. When replacing the packing ring, the tool is used to assist it over the shoulder of the piston rod.

h. Tool, packing gland (plug).—This tool consists of a hollow cylindrical steel body having a 0.4-inch diameter by 3-inch long plug protruding at one end. It is used to drive the packing out of the stuffing box after the latter has been removed from the recoil mechanism.

i. Tool, packing ring.—This tool consists of a 4-inch length of steel rod threaded at one end and having a knob at the other end. It is used for withdrawing the outer packing support ring from the recoil mechanism when renewing the hydraulic packing.

j. Wrenches.—(1) The straight pattern hexagon opening socket wrench is for removing and replacing the gravity tank valve seat.

(2) The singlehead wrench of 4½-inch length is provided to open the recoil cylinder air valve when filling the recoil cylinder with oil.

(3) The octagon box wrench of 21-inch length is used to remove the axle dust caps from the carriage.

(4) The doublehead engineers wrench is for disassembling and assembling parts of the recoil mechanism. It has openings of 1.4 and 2.43 inches.

(5) The combination hexagon box and doublehook spanner wrench is used on the stuffing box, piston rod nut, or gland when renewing or adjusting the packing of the recoil mechanism.

(6) The combination box wrench with square head and screw driver end is used on the filling plug.

(7) The small combination singlehead wrench with screw driver end is used to remove or replace lubricating fittings.

CHAPTER 6

SUBCALIBER EQUIPMENT

	Paragraph
General	82
Description and operation	83
Bore sighting	84
Care and preservation	85
Spare parts and accessories	86

82. General.—Subcaliber equipment is used to provide a means for a greater amount of training with small caliber ammunition than would be obtained by the use of regular 75-mm ammunition. Although the handling and loading as well as the range obtained differ from those of the regular pieces, the results obtained in elevating, traversing, sighting, etc., are adequate for instructional purposes. The 37-mm subcaliber gun, M1916A1, used for subcaliber firing, is inserted in the chamber of the 75-mm gun by means of suitable adapters.

83. Description and operation.—*a.* The 37-mm subcaliber gun, M1916A1, consists of a 37-mm gun barrel mounted in two adapters, one front and one rear.

b. The breech end of the barrel is threaded and screws into the rear adapter. A section of the muzzle end of the barrel is also threaded and is screwed into the front adapter. The rear adapter is similar to the base of a cartridge and fits against the breech face of the 75-mm gun. The front adapter is for the purpose of centering the subcaliber gun barrel in the bore of the 75-mm gun.

NOTE.—To prevent damaging, the extractor of the 75-mm gun must be removed from the breech mechanism during subcaliber practices.

84. Bore sighting.—As the subcaliber gun is to be laid with the regular sighting and maneuvering mechanism of the 75-mm gun, bore sighting will be performed as outlined for the 75-mm gun.

85. Care and preservation.—Repairs to the subcaliber equipment will be minor in nature and will involve only the removal of burs when necessary and the replacement of parts.

86. Spare parts and accessories.—The spare parts and accessories for the subcaliber equipment are listed in SNL C-9 and SNL C-27, the former horse-drawn and the latter high-speed artillery.

CHAPTER 7

MATERIAL AFFECTED BY GAS

	Paragraph
Protection against phosgene, chlorine, etc.-----	87
Protection against mustard gas.-----	88
Disinfection of material affected by mustard gas.-----	89

87. Protection against phosgene, chlorine, etc.—*a.* For material which is in constant danger of gas attacks, whether from gas clouds or gas shells, care should be taken to keep all bright parts of the guns, carriages, mountings, and accessories well coated with oil.

b. Sights and all instruments should also be covered with oil and protected with covers when not in actual use, care being taken that the oil does not come in contact with any glass or find its way into the interior of the instruments.

c. All uncapped fuzes or fuzes which have been removed from their containers should be wiped over with oil as soon as possible and protected with a cover.

88. Protection against mustard gas.—*a. General.*—It must be remembered that practically all fabrics and materials such as wool, cotton, rubber, and oilcloth can be penetrated by mustard gas if exposed to it a sufficient length of time. The mustard gas is absorbed by these materials and penetrates them by a slow process of diffusion. In general, it may be said that the greater the length of time allowed for penetration, the greater the danger in wearing these articles. For instance, rubber boots which have been worn in an area shelled heavily with mustard gas may be a grave danger to men who wear them several days after the bombardment. Fabrics thoroughly impregnated with boiled linseed oil will resist penetration by mustard gas for over an hour, but after this time these articles are dangerous because the mustard gas dissolves in the linseed oil and they must be destroyed.

b. Cleaning.—All bright parts of guns and carriages, together with all accessories and spare parts exposed to the gas, must be cleaned and wiped dry as soon as possible after the attack and in any case within 24 hours, after which they should be thoroughly coated afresh with oil. The same applies to the whole of the ammunition still in the battery position. Ammunition which for any reason has not been

oiled must be cleaned and oiled. It is desirable to expend it as soon as possible.

89. Disinfection of material affected by mustard gas.—The following measures should be taken for the removal of gas from various materials and equipment (guns, projectiles, cases, wood, metals, rope, etc.) which have come in contact with mustard gas. For all of the operations indicated below, the gas mask and protective clothing, including protective shoes and gloves, must be worn.

a. Commence by freeing the objects of dirt, lumps of earth, and liquid with wooden spatulas, rags, etc., which will be buried immediately after this operation. They must never be burned.

b. Sprinkle a continuous layer of calcium hypochlorite, which is preferred, if available, or else dry chloride of lime over the parts that lend themselves to this treatment. In the statements hereafter, calcium hypochlorite is specified but dry chloride of lime may be substituted if calcium hypochlorite is not available. After 2 hours, or better after 6 hours if practicable, wash off the layer of calcium hypochlorite and rinse thoroughly. It is imperative that all the calcium hypochlorite be removed in order to prevent the deterioration resulting from the prolonged action of the calcium hypochlorite. In the case of ammunition it is imperative to prevent particles of calcium hypochlorite from being introduced into the bore of the piece.

c. Whitewash soiled parts, which do not lend themselves to sprinkling with dry powder, with a thick paste of calcium hypochlorite made from three volumes of calcium hypochlorite and one volume of water. After 2 hours, or preferably 6 hours, wash off the calcium hypochlorite.

d. The delicate parts of the apparatus, such as breech mechanism, sighting apparatus, glasses, etc., which would be injured by calcium hypochlorite, should be cleaned by dry polishing with rags. After this operation the rags should be buried.

e. If there are large quantities of water at hand, in the place of calcium hypochlorite use water. The water should be warm, but not boiling, and large quantities should be used. This cannot be done in the case of greasy articles, where only calcium hypochlorite should be used.

f. When it is not necessary to use contaminated material immediately, or when one has not the above means at his disposal, it may be considered that the handling of the material or apparatus is not dangerous after 6 or 8 days.

g. The material will be disinfected as thoroughly as possible before its removal.

APPENDIX

LIST OF REFERENCES

1. Standard nomenclature lists.

Gun and carriage, 37-mm, M1916, and carriages, 37 mm gun, M1916A1 and M1916A2-----	SNL A-7
Gun and carriage, 75-mm, M1917 (Brit- ish) -----	SNL C-9
Gun and carriage, 75-mm, M1917A1-----	SNL C-27
Major items—Small arms, automatic gun, trench mortar, and field artillery sight- ing equipment and fire control instru- ments-----	SNL F-1
Material, cleaning and preserving, and tools and equipment used therewith----	SNL K-1
Ammunition, fixed, all types, for pack, light, and medium field artillery-----	SNL R-1
Service fuzes and primers, for pack, light, and medium field artillery-----	SNL R-3
Current Standard Nomenclature Lists are as tabulated here. An up-to-date list of SNL's is maintained as the "Ord- nance Publications for Supply Index" -	(OPSI)

2. Firing tables and trajectory charts.

Gun, 75-mm, M1916 and M1917 (British).	
Carriage, 75-mm, M1916 and M1916MI.	
Carriage, 75-mm, M1917 (British).	
Shrapnel, Mk. I, fuze, 21-sec. com- bination, M 1907M.	
Shell, H. E., Mk. I, and	
Shell, chemical, Mk. II, with fuze, P. D., M46, M47, Mk. III, Mk.	
IV, Mk. V, and M35-----	FT 75-E-3
Shell, Mk. I, fuze, short, Mk. V, re- duced charge-----	TD 75-E-1, 2b
Shell, Mk. I, fuze, long, Mk. III, normal charge-----	TD 75-E-1, 2d
Shell, Mk. IV, fuze, long, Mk. III.	TD 75-E-1, 2f

2. Firing tables and trajectory charts—Continued.

Gun, 37-mm, M1916, on subcaliber mount

Shell, L. E., Mk. I, fuze, B. D., Mk.

I and Mk. II----- FT 37-H-2

Shell, practice, Mk. II----- FT 37-O-1

(Abridged)

Current firing tables are as tabulated here.

An up-to-date list of firing tables is
maintained in-----

SNL F-69

3. Technical manuals.

Cleaning and preserving materials, oils,
greases, and cutting compounds issued
by Ordnance Department-----

TM 9-850 (now
published as TR
1395-A)

Ammunition, general -----

TM 9-900 (now
published as TR
1370-A)

4. Field manual.

Service of the piece, 75-mm gun, M1917A1,
truck-drawn-----

FM 6-65

INDEX

	Paragraph	Page
Abrasives and cleaners.....	34	26
Accessories.....	81	89
Subcaliber.....	86	92
Aiming:		
Circle, M1.....	45	53
Post—		
Lamp.....	39	44
M1.....	40	45
Ammunition.....	52	72
Care, handling and preservation.....	62	75
Classification.....	54	73
Data card.....	59	74
Firing tables.....	55	73
Fuzes.....	64-77	78
Identification.....	56	73
Lot number.....	58	73
Mark or model.....	57	73
Nomenclature.....	53	73
Packing.....	78	84
Painting and marking.....	60	74
Rounds, authorized.....	63	76
Subcaliber.....	79	84
Weight zone markings.....	61	75
Assembly of:		
Breech mechanism.....	15	12
Gun and carriage.....	13	11
Recoil mechanism.....	17	13
Scale ring, yards and degrees.....	21	14
Spring case, outer, to cradle.....	19	13
Bore:		
Sight.....	42	47
Sighting.....	84	92
Brake mechanism, care and preservation.....	31	24
75-mm gun carriage, M1917.....	32	24
Breech mechanism:		
Assembly.....	15	12
Disassembly.....	14	11
Operation.....	8	5
Care and preservation of:		
Brake mechanism.....	31	24
75-mm gun carriage, M1917.....	32	24
Carriage.....	29	20
Equipment:		
Fire control and sighting.....	51	70
Subcaliber.....	85	92
Gun.....	28	18
Recoil mechanism.....	30	23
Care, handling, and preservation of ammunition.....	62	75
Carriage:		
M1917.....	5	3
Inspection.....	24	16
M1917A1.....	5	3
Inspection.....	23	15
Malfunction.....	27	18
Chlorine, phosgene, etc., protection against.....	87	93

	Paragraph	Page
Circle, aiming, M1.....	45	53
Cleaners and abrasives.....	34	26
Compass, prismatic, M1918 (Sperry).....	46	56
Data card, ammunition.....	59	74
Disassembly:		
Breech mechanism.....	14	11
Gun and carriage.....	13	11
Recoil mechanism.....	16	12
Scale ring, yards and degrees.....	20	14
Spring case, outer, from cradle.....	19	13
Disinfection of material affected by mustard gas.....	89	94
Equipment:		
Fire control and sighting, care and preservation.....	51	70
Subcaliber.....	82	92
Care and preservation.....	85	92
Description and operation.....	83	92
Spare parts and accessories.....	86	92
Finder, range, 1-meter base, M1916.....	47	58
Fire-control equipment, care and preservation.....	51	70
Firing—		
Mechanism, operation.....	9	5
Tables.....	55	73
Fuze setter:		
Bracket, M1916.....	48	63
Hand, M1912.....	49	65
Fuzes.....	64	78
Combination, 21-second, M1907.....	77	83
P. D.:		
M35.....	71	81
M46.....	72	81
M47.....	73	82
M48.....	74	82
M54.....	75	83
Superquick:		
Mk. III:		
With interrupter.....	66	79
Without interrupter.....	65	79
Mk. IIIA:		
With interrupter.....	68	80
Without interrupter.....	67	80
Mk. IV, short delay.....	69	80
Star.....	70	81
T18.....	76	83
Guns:		
75-mm, M1917.....	4	3
Description.....	7	4
Care and preservation.....	28	18
Inspection.....	22	14
Malfunction of.....	26	17
Gun and carriage, 75-mm, M1917, and modifications:		
Assembly and disassembly.....	13	11
Manual on:		
Purpose.....	1	1
Scope.....	2	1
References on.....	3	2
Gun carriage, 75-mm:		
M1917:		
Description.....	11	10
Operation.....	12	11
M1917A1:		
Description.....	10	5
Operation.....	12	11

75-MM GUN AND CARRIAGE, M1917

G-S

	Paragraph	Page
Gunner's quadrant, M1918.....	41	45
Inspection:		
Carriage, 75-mm gun:		
M1917.....	24	16
M1917A1.....	23	15
Gun.....	22	14
Lamp, aiming post.....	39	44
Lubricants.....	37	30
Lubrication instructions.....	33	24
Malfunction:		
Carriage.....	27	18
Gun.....	26	17
Marking and painting ammunition.....	60	74
Materials and tools, miscellaneous.....	38	31
Mustard gas:		
Disinfection of material affected by.....	89	94
Protection against.....	88	93
Paint and related materials.....	36	27
Painting and marking ammunition.....	60	74
Panoramic telescope, M6.....	43	47
Parts, spare.....	80	89
Subcaliber equipment.....	86	92
Post, aiming, M1.....	40	45
Preservatives.....	35	27
Prismatic compass, M1918 (Sperry).....	46	56
Protection against—		
Mustard gas.....	88	93
Phosgene, chlorine, etc.....	87	93
Quadrant, gunner's, M1918.....	41	45
Range finder, 1-meter base, M1916.....	47	58
Recoil mechanism:		
Assembly.....	17	13
Care and preservation.....	30	23
Disassembly.....	16	12
Function.....	25	16
With gravity tank.....	6	3
Rocking bar sight, type F.....	43	47
Rounds, ammunition, authorized.....	63	76
Scale ring, yards and degrees:		
Assembly.....	21	14
Disassembly.....	20	14
Setter, fuze:		
Bracket, M1916.....	48	63
Hand, M1912.....	49	65
Sight:		
Bore.....	42	47
Rocking bar, type F.....	43	47
Sighting, bore.....	84	92
Sighting and fire-control equipment, care and preservation.....	51	70
Spare parts.....	80	89
Subcaliber equipment.....	86	92
Spring case, outer:		
Assembly to cradle.....	19	13
Disassembly from cradle.....	18	13
Subcaliber—		
Ammunition.....	79	84
Equipment.....	82	92
Care and preservation.....	85	92
Description and operation.....	83	92
Spare parts and accessories.....	86	92

	Paragraph	Page
Target testing.....	44	53
Telescopes:		
BC, M1915.....	50	66
Panoramic, M6.....	43	47
Tools and materials, miscellaneous.....	38	31
Weight zone markings, ammunition.....	61	75

[A. G. 062.11 (7-23-40).]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:

E. S. ADAMS,
Major General,
The Adjutant General.

